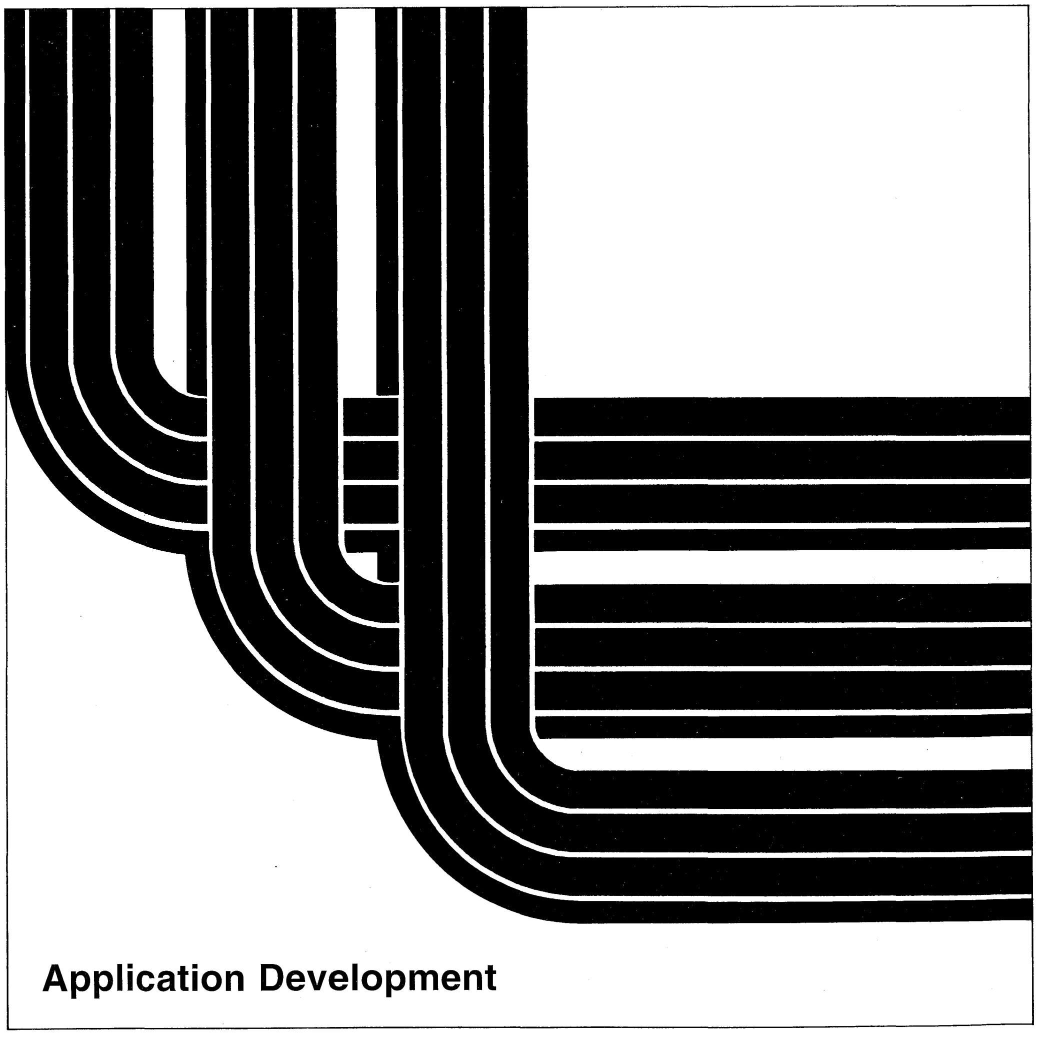
Application System/400

SC41-9658-02

Data Management Guide

Version 2



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Take Note!

Before using this information and the product it supports, be sure to read the general information under "Notices" on page xi.

| **Third Edition (November 1993)**

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Refer to the "Summary of Changes" on page xv for a summary of changes made to data management and how they are described in this publication.

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About This Guide

This guide describes the data management portion of the Operating System/400 licensed program. Data management provides applications with access to input and output file data that is external to the application. There are several types of these input and output files, and each file type has its own characteristics. In addition, all of the file types share a common set of characteristics. This guide describes the characteristics and programming use of database files and spooled files. Printer device characteristics and programming use are described in the *Guide to Programming for Printing*, SC41-8194. Display device file characteristics and programming use are described in the manual *Guide to Programming Application and Help Displays*, SC41-0011. Tape and diskette characteristics and programming use are described in *Guide to Programming for Tape and Diskette*, SC41-0012.

After you understand *what* data management support provides, you can proceed to learn *how* to use that support. The how-to aspect of data management is covered in two other groups of manuals: the high-level language manuals and the manuals that describe the various tools on the system for describing, creating, and maintaining files.

The high-level language manuals describe how to interact with the data management support. For example, they describe the syntax for extracting file descriptions from the system and including them in the program, and how to code a read operation using a keyed access path.

The tools manuals are similar to the language manuals in that the syntax of using data management is described. For example, the *Data Description Specifications Reference*, SC41-9620, describes the syntax for creating field, record, and file descriptions that are associated with a file; the *Programming: Control Language Reference*, SC41-0030, describes the syntax for the command that creates the file using the DDS file description.

You may need to refer to other IBM manuals for more specific information about a particular topic. The *Publications Guide*, GC41-9678, provides information on all the manuals in the AS/400 library.

For a list of publications related to this guide, see the "Bibliography."

Who Should Use This Guide

This guide is intended primarily for the application programmer. This guide should also be useful for those responsible for tailoring their system to use double-byte data with the data management file support.

Before using this guide, you should be familiar with general programming concepts and terminology, and have a general understanding of the AS/400 system and OS/400 operating system.

Summary of Changes

Authority Change for CPYF and CPYFRMQRYF Commands

When a local physical file is created by the Copy File (CPYF) command or the Copy from Query File (CPYFRMQRYF) command, the created to-file is given all the authorities of the from-file. For more information, see "Creating the To-File (CRTFILE Parameter)" on page 4-12.

Override Commands

Override commands can be scoped to the job level by specifying OVRSCOPE(*JOB) on the command. To **scope** is to specify the boundary within which systems resources can be used. Overrides that are scoped to the job level remain in effect until they are replaced, deleted, or until the job in which they are specified ends. For more information on overrides that are scoped to the job level, see Chapter 3, "Overrides and File Redirection."

Controllers that Support Enhanced Interface for Nonprogrammable Work Stations

These controllers are now supported. Appendix A, "Feedback Area Layouts" shows the information you can obtain about display stations from the I/O Feedback area using the get attributes operation.

Chapter 1. Introduction

Data management is the part of the operating system that controls the storing and accessing of data by an application program. The data may be on internal storage (for example, database), on external media (diskette, tape, printer), or on another system. Data management, then, provides the functions that an application uses in creating and accessing data on the system and ensures the integrity of the data according to the definitions of the application.

Data management provides functions that allow you to manage files (create, change, override, or delete) using CL commands, and create and access data through a set of operations (for example, read, write, open, or close). Data management also provides you with the capability to access external devices and control the use of their attributes for creating and accessing data.

If you want to make more efficient use of printers and diskette devices, data management provides the capability of spooling data for input or output. For example, data being written to a printer can be held on an output queue until the printer is available for printing.

On the IBM* AS/400* system, each file (also called a file object) has a description that describes the file characteristics and how the data associated with the file is organized into records, and, in many cases, the fields in the records. Whenever a file is processed, the operating system (the Operating System/400* or OS/400* program) uses this description.

You can create and access data on the system by using these file objects. Data management defines and controls several different types of files. Each file type has associated CL commands to create and change the file, and you can also create and access data through the operations provided by data management.

File Types: The data management functions support the following types of files:

Database files are files whose associated data is stored permanently in the system.

Device files are files that provide access to externally attached devices such as displays, printers, tapes, diskettes, and other systems that are attached by a communications line. The device files supported are:

- Display files, which provide access to display devices
- Printer files, which describe the format of printed output
- Tape files, which allow access to data files on tape devices
- Diskette files, which provide access to data files on diskette devices
- **Intersystem communications function** (OS/400-ICF) files, hereafter referred to as ICF files, which allow a program on one system to communicate with a program on the same system or another system

Save files are files that are used to store saved data on disk (without requiring diskettes or tapes).

Distributed data management (DDM) files are files that allow access to data files stored on remote systems.

Each file type has its own set of unique characteristics that determines how the file can be used and what capabilities it can provide. The concept of a file, however, is the same regardless of what type of file it is. When a file is used by a program, it is referred to by name, which identifies both the file description and, for some file types, the data itself. This manual is designed to help you understand the common characteristics of all file types so you can use the files to their full capabilities.

Chapter 2. File Processing

This chapter discusses basic aspects of processing files. Topics include:

- File operations supported by the system for use in high-level language programs
- File security considerations
- Sharing files in the same job
- Allocating file resources
- Temporarily changing a file when a program uses it
- Feedback areas maintained by the system
- Handling file errors when programs run

Data Management Operations Overview

Data management supports many operations that high-level language programs can use to process data. These include the following, which are grouped by category:

- File Preparation

  OPEN
  Attaches a file to a program and prepares it for I/O operations. A file may be opened for any combination of read, write, update, or delete operations.

  ACQUIRE
  Attaches a device or establishes a communications session for an open file in preparation for I/O operations.

- Input/Output

  READ
  Transfers a record from the file to the program. The data is made available to the program once the read has been successfully completed.

  WRITE
  Transfers a record from the program to the file.

  WRITE-READ
  Combines the WRITE and READ operations as one operation.

  UPDATE
  Updates a record with changed data. The record must have been successfully read prior to the update operation.

  DELETE
  Deletes a record in a file. The record must have been successfully read prior to the delete operation.

- Commitment Control

  COMMIT
  Guarantees a group of changes are made as a complete transaction across multiple records or multiple files.

  ROLLBACK
  Rolls back a group of changes to the point of the last commit operation.

- Completion

  FEOD
  Positions the file at the last volume or at the end of data. For those programs processing files for output, the last buffer of data is written. For those programs processing files for input, an end-of-file condition is forced for the next input operation.

  RELEASE
  Detaches a device or a communications session from an open file. I/O operations can no longer be performed for this device or session.

  CLOSE
  Detaches a file from a program, ending I/O operations. Any remaining data in the output buffer that has not been written will be written prior to the completion of the close.

The operations listed above have certain restrictions based on file type and language support. For example, a program may not write to a file that has been opened for read only. Similarly, a read-by-key may not be issued for an ICF file. Since file overrides can occur during processing, an operation may not be allowed for the type of file that is ultimately being processed. See Chapter 3, "Overrides and File Redirection," for additional information.

Table 2-1 on page 2-3 lists the file types and the main operations that are allowed. There are additional functions supported for some file types that are accomplished by additional operations or changes to these operations. For information on these additional functions and how the operations given here apply to display, tape, and diskette files, refer to either the *Guide to Programming Displays* or the *Guide to Programming for Tape and Diskette*. For equivalent information for database, ICF, DDM, printer, and save files, refer to the *Database Guide*, the *ICF Programmer's Guide*, the *DDM Guide*, the *Guide to Programming for Printing*, and the *Advanced Backup and Recovery Guide*, respectively.

Table 2-2 on page 2-4 and Table 2-3 on page 2-5 map the OS/400-supported operations given in Table 2-1 on page 2-3 to the high-level language operations (BASIC, C/400*, RM/COBOL-85** for the AS/400 system, COBOL/400*, FORTRAN/400*, PASCAL, PL/I, and RPG/400* programming languages) supported on the system. For additional information on each operation and how it correlates to the file declaration in the program, see the appropriate language manual. Note that not all OS/400 operations are supported in all languages.

Table 2-1. File Types and Their Main Operations

	File Types							
Operation	**Database**	**Diskette**	**Tape**	**Printer**	**Display**	**ICF**	**DDM**	**Save**
OPEN								
Read	X	X	X	-	X	X	X	X
Write	X	X	X	X	X	X	X	X
Update	X	-	-	-	X[1]	-	X	-
Delete	X	-	-	-	X[1]	-	X	-
READ								
By relative record number	X	-	-	-	X[1]	-	X	-
By key	X	-	-	-	-	-	X	-
Sequential	X	X	X	-	X	X	X	X
Previous	X	-	X	-	-	-	X	-
Next	X	X	X	-	X	X	X	X
Invited Device	-	-	-	-	X	X	-	-
WRITE-READ	-	-	-	-	X	X	-	-
WRITE								
By relative record number	X	-	-	-	X[1]	-	X	-
By key	X	-	-	-	-	-	X	-
Sequential	X	X	X	X	X	X	X	X
FEOD	X	X	X	X	-	-	X	X
UPDATE								
By relative record number	X	-	-	-	X[1]	-	X	-
By key	X	-	-	-	-	-	X	-
DELETE								
By relative record number	X	-	-	-	-	-	X	-
By key	X	-	-	-	-	-	X	-
ACQUIRE	-	-	-	-	X	X	-	-
RELEASE	-	-	-	-	X	X	-	-
COMMIT	X	-	-	-	-	-	-	-
ROLLBACK	X	-	-	-	-	-	-	-
CLOSE	X	X	X	X	X	X	X	X

[1] Operation allowed only for subfile record formats

Table 2-2. High-Level Languages and Their OS/400 Operations

	High-Level Languages			
Operation	**BASIC**	**C/400 Programming Language**	**RM/COBOL-85 for the AS/400 System**	**COBOL/400 Programming Language**
OPEN				
Read	OPEN INPUT	fopen, _Ropen	OPEN INPUT, OPEN I-O	OPEN INPUT
Write	OPEN OUTPUT	fopen, _Ropen	OPEN OUTPUT, OPEN EXTEND	OPEN OUTPUT, OPEN EXTEND
Update	OPEN OUTIN	fopen, _Ropen	OPEN I-O	OPEN I-O
Delete	OPEN OUTIN	fopen, _Ropen	OPEN I-O	OPEN I-O
READ				
By relative record number	READ REC	_Rreadd	READ	READ
By key	READ KEY	_Rreadk, _Rformat	READ	READ KEY
Sequential	READ NEXT, GET	fread, fgetc, fgets, QXXPGMDEV, QXXFORMAT, _Rreadf, _Rreadl, _Rreadn, _Rreadp, _Rreads, _Rformat, _Rpgmdev	READ	READ
Previous	READ PRIOR	_Rreadp		READ
Next	READ NXT, GET	fread, _Rreadn		READ, READ NEXT
Invited Device		QXXREADINVDEV followed by fread, _Rreadindv		READ
WRITE-READ		_Rwriterd, _Rformat, _Rpgmdev		
WRITE				
By relative record number	WRITE REC	_Rwrited	WRITE	WRITE
By key	WRITE	_Rwrite, _Rformat	WRITE	
Sequential	WRITE	fwrite, fputc, fputs, QXXPGMDEV, QXXFORMAT, _Rwrite, _Rformat, _Rpgmdev	WRITE	WRITE
FEOD		_Rfeod		
UPDATE				
By relative record number	REWRITE REC	_Rupdate	REWRITE	REWRITE
By key	REWRITE KEY	_Rupdate	REWRITE	REWRITE
DELETE				
By relative record number	DELETE REC	_Rdelete	DELETE	DELETE
By key	DELETE KEY	_Rdelete	DELETE	DELETE
ACQUIRE		QXXACQUIRE, _Racquire		ACQUIRE
RELEASE		QXXRELEASE, _Rrelease		DROP
COMMIT		QXXCOMMIT, _Rcommit		COMMIT
ROLLBACK		QXXROLLBCK, _Rrollbck		ROLLBACK
CLOSE	CLOSE, END	fclose, _Rclose	CLOSE, STOP RUN, CANCEL, GOBACK	CLOSE, STOP RUN, CANCEL

Table 2-3 (Page 1 of 2). High-Level Languages and Their OS/400 Operations

	High-Level Languages			
Operation	**FORTRAN/400 Programming Language**	**PASCAL**	**PL/I**	**RPG/400 Programming Language**
OPEN				
Read	OPEN ACTION='READ', READ	RESET, GET, READ, READLN	OPEN INPUT	OPEN, primary file
Write	OPEN ACTION='WRITE', WRITE	REWRITE, WRITE, WRITELN	OPEN OUTPUT	OPEN, primary file
Update	OPEN ACTION='READ/WRITE', WRITE	UPDATE	OPEN UPDATE	OPEN, primary file
Delete		UPDATE	OPEN UPDATE	OPEN, primary file
READ				
By relative record number	READ REC	GET, READ	READ KEY	READ, CHAIN
By key			READ KEY	READ, READE, CHAIN
Sequential	READ	GET, READ, READLN	READ NEXT, GET	READ, primary file
Previous	BACKSPACE READ	GET, READ, READLN	READ PRV	READP, REDPE
Next	READ	GET, READ, READLN	READ NXT, GET	READ, READE
Invited Device				READ
WRITE-READ				EXFMT
WRITE				
By relative record number	WRITE REC	PUT, WRITE, WRITELN	WRITE, EXCPT primary file	
By key			WRITE KEY	WRITE, EXCPT
Sequential	WRITE	PUT, WRITE, WRITELN	WRITE, PUT	WRITE, EXCPT primary file
FEOD				FEOD
UPDATE				
By relative record number	WRITE REC	PUT, WRITE, WRITELN	REWRITE KEY	UPDAT, primary file
By key			REWRITE KEY	UPDAT, primary file
DELETE				
By relative record number			DELETE	DELET, primary file
By key			DELETE KEY	DELET, primary file
ACQUIRE				ACQ
RELEASE				REL
COMMIT		use CL COMMIT	PLICOMMIT subroutine	COMIT
ROLLBACK		use CL ROLLBACK	PLIROLLBACK subroutine	ROLBK

Table 2-3 (Page 2 of 2). High-Level Languages and Their OS/400 Operations

	High-Level Languages			
Operation	**FORTRAN/400 Programming Language**	**PASCAL**	**PL/I**	**RPG/400 Programming Language**
CLOSE	CLOSE, END	CLOSE, END	CLOSE, STOP	CLOSE, RETRN

Security Considerations

This section describes some of the file security functions. The topics covered include the authorizations needed to use files and considerations for specifying these authorities when creating a file. For more information about using the security function on the system, see the *Security Reference* manual.

File Object Authority

The following describes the types of authority that can be granted to a user for a file:

Object Operational Authority: Allows you to look at an object description and use the object as determined by your data authorities to the object. Object operational authority is required to:

- Open the file for processing. You must also have read authority to the file. For device files that are not using spooling, you must have object operational and also all data authorities to the device.
- Compile a program which uses the file description.
- Display the file description.
- Delete the file.
- Transfer ownership of the file.
- Grant and revoke authority.
- Change the file description.
- Move or rename the file.

Object Existence Authority: Object existence authority is required to:

- Delete the file.
- Save, restore, and free the storage of the file.
- Transfer ownership of the file.

Object Management Authority: Object management authority is required to:

- Grant and revoke authority. You can grant and revoke only the authority that you already have.
- Change the file description.
- Move or rename the file.

File Data Authorities

Data authorities can be granted to a file. You need:

- Read authority to open any file for input, compile a program using the file, or display the file description.
- Add authority to add new records to the file.
- Update database file records to open a database file for update.
- Delete authority to open a database file for delete.

For files other than database and save files, the add, update, and delete authorities are ignored.

Authorities Required for File Operations

Table 2-4 on page 2-7 lists the file object authority and the data authority required for file functions. This is the same information that was presented in the previous two sections, but it is listed by function rather than by authority.

Table 2-4. Object Authority and Data Authority Required for File Operations

Function	Object Operational	Object Existence	Object Management	Read	Add	Update	Delete
Open, I/O, close file[1]	X			X	X[2]	X[3]	X[3]
Compile a program using the file description	X			X			
Display file description	X			X			
Delete file	X	X					
Save/restore		X					
Transfer ownership	X	X					
Grant/revoke authority	X		X				
Change file description	X		X				
Move file	X		X				
Rename file	X		X				
Replace file	X	X	X	X			

1 For device files that are not using spooling, you must also have object operational and all data authorities to the device.

2 Open for output for database and save files.

3 Open for update or delete for database files.

Specifying Authorities When Creating Files

When you create a file, you can specify public authority through the AUT parameter on the create command. Public authority is authority available to any user who does not have specific authority to the file or who is not a member of a group that has specific authority to the file. That is, if the user has specific authority to a file or the user is a member of a group with specific authority, then the public authority is not checked when a user performs an operation to the file. Public authority can be specified as:

- *LIBCRTAUT. All users that do not have specific user or group authority to the file have authority determined by the library in which the file is being created. The library value is specified by the *CRTAUT command to establish a public authority for this library.
- *CHANGE. All users that do not have specific user or group authority to the file have authority to use the file. The *CHANGE value is the default public authority. *CHANGE grants any user object operational and all data authorities.
- *USE. All users that do not have specific user or group authority to the file have authority to use the file. *USE grants any user object operational and read data authority.
- *EXCLUDE. Only the owner, security officer, users with specific authority, or users who are members of a group with specific authority can change or use the file.
- *ALL. All users that do not have specific user or group authority to the file have all data authorities along with object operational, object management, and object existence authorities.
- Authorization list name. An authorization list is a list of users and their authorities. The list allows users and their different authorities to be grouped together.

You can use the Edit Object Authority (EDTOBJAUT), Grant Object Authority (GRTOBJAUT), or Revoke Object Authority (RVKOBJAUT) commands to grant or revoke the public authority of a file.

Sharing Files

By default, the system lets one file be used by many users and more than one job at the same time. The system allocates the file and its associated resources for each use of the file in such a way that conflicting uses are prevented.

Within the same job, files can be shared if one program opens the same file more than once or if different programs open the same file. Even though the same file is being used, each open operation creates a new path from the program to the data or device, so that each open represents an independent use of the file.

Historically, the file sharing just discussed was the limit of the file sharing available. However, OS/400 data management support offers another closer level of sharing within a job that allows more than one program to share the same path to the data or device.

This level of sharing is available by specifying the SHARE parameter on the create file, change file, and override file commands. Using the SHARE parameter allows more than one program to share the file status, positions, and storage area, and can improve performance by reducing the amount of main storage the job needs and by reducing the time it takes to open and close the file.

The **original program model** is the set of functions for compiling source code and creating high-level language programs on the AS/400 system before the Integrated Language Environment (ILE) model was introduced. The **ILE model** is the set of constructs and interfaces that provide a common run-time environment and run-time bindable application program interfaces (APIs) for all ILE-conforming high-level languages.

An **open data path** is the path through which all input/output operations for the file are performed. In the original program model, using the SHARE(*YES) parameter lets two or more programs running in the same job share an open data path (ODP). It connects the program to a file. If not specified otherwise, every time a file is opened a new open data path is built. You can specify that if a file is opened more than once and an open data path is still active for it in the same job, the active ODP for the file can be used with the current open of the file, and a new open data path does not have to be created. This reduces the amount of time required to open the file after the first open, and the amount of main storage required by the job. SHARE(*YES) must be specified for the first open and other opens of the same file for the open data path to be shared. A well-designed (for performance) application will normally do a shared open on database files that will be opened in multiple programs in the same job. Specifying SHARE(*YES) for other files depends on the application.

In the ILE model, shared files are scoped either to the job level or to the activation group level. An **activation group** is a substructure of a run-time job. It consists of system resources (storage for program or procedure variables, commitment definitions, and open files) allocated to one or more programs. An activation group is like a miniature job within a job.

Shared files that are scoped to the job level can be shared by any programs running in any activation group. Shared files that are scoped to the activation group level can be shared only by programs running in the same activation group.

Sharing files allows you to have programs within a job interact in ways that would otherwise not be possible. However, you should read the considerations for open, I/O, and close in this section and in the appropriate manuals for all the file types to understand how this support works and the rules programs must follow to use it correctly.

Note: Most high-level language programs process an open or a close operation independent of whether or not the file is being shared. You do not specify that the file is being shared in the high-level language program. You indicate that the file is being shared in the same job through the SHARE parameter. The SHARE parameter is specified only on the create, change, and override file commands. Refer to your appropriate language manual for more information.

Open Considerations for Files Shared in a Job

The following items should be considered when opening a file that is shared in the same job by specifying SHARE(*YES).

- You must make sure that when the shared file is opened for the first time in a job, all the open options that are needed for subsequent opens of the file are specified. If the open options specified for subsequent opens of a shared file do not match those specified for the first open of a shared file, an error message is sent to the program. (You can correct this by making changes to your program to remove any incompatible options.)

  For example, PGMA is the first program to open FILE1 in the job and PGMA only needs to read the file. However, PGMA calls PGMB which will delete records from the same shared file. Because PGMB will delete records from the shared file, PGMA will have to open the file as if it, PGMA, is also going to delete records. You can accomplish this by using the correct specifications in the high-level language. (In order to accomplish this in some high-level languages, you may have to use file operation statements that are never run. See your appropriate language manual for more details.)

- Sometimes sharing a file within a job is not possible. For example, one program may need records from a file in arrival sequence and another program may need the records in keyed sequence. Or, you may use the same file for printing output, but want the output from each program to be produced separately. In these situations, you should not share the open data path. You would specify SHARE(*NO) on the override command to ensure that the file was not shared within the job.

- If debug mode is entered with UPDPROD(*NO) after the first open of a shared file in a production library, subsequent shared opens of the file share the original open data path and allow the file to be changed. To prevent this, specify SHARE(*NO) on the override command before opening files while debugging your program.

- The use of commitment control for the first open of a shared file, requires that all subsequent shared opens also use commitment control.

- If you did not specify a library name in the program or the override command (*LIBL is used), the system assumes that the library list has not changed since the last open of the same shared file with *LIBL specified. If the library list has changed, you should specify the library name on the override command to ensure that the correct file is opened.

- Overrides and program specifications specified on the first open of the shared file are processed. Overrides and program specifications specified on subsequent opens, other than those that change the file name or the value specified on the SHARE or LVLCHK parameters on the override command, are ignored.

Input/Output Considerations for Files Shared in a Job

The system uses the same input/output area for all programs sharing the file, so the order of the operations is sequential regardless of which program does the operation. For example, if Program A is reading records sequentially from a database file and it reads record 1 just before calling Program B, and Program B also reads the file sequentially, Program B reads record 2 with the first read operation. If Program B then ends and Program A reads the next record, it receives record 3. If the file was not being shared, Program A would read record 1 and record 2, and Program B would read record 1.

For device files, the device remains in the same state as the last I/O operation.

For display and ICF files, programs other than the first program that opens the file may acquire more display or program devices or release display or program devices already acquired to the open data path. All programs sharing the file have access to the newly acquired devices, and do not have access to any released devices.

Close Considerations for Files Shared in a Job

The processing done when a program closes a shared file depends on whether there are other programs currently sharing the open data path. If there are other programs, the main function that is performed is to detach the program requesting the close from the file. For database files, any record locks held by the program are also released. The program will not be able to use the shared file unless it opens it again. All other programs sharing the file are still attached to the ODP and can perform I/O operations.

If the program closing the file is the last program sharing the file, then the close operation performs all the functions it would if the file had not been opened with the share option. This includes releasing any allocated resources for the file and destroying the open data path.

The function provided by this last close operation is the function that is required for recovering from certain run-time errors. If your application is written to recover from such errors and it uses a shared file, this means that all programs that are attached to the file when the error occurs will have to close the file. This may require returning to previous programs in the call stack and closing the file in each one of those programs.

Allocating File Resources

When a high-level language program uses a file, several operations require that the system allocate the resources needed to perform that operation. This is generally done to ensure that multiple users do not use the file in conflicting ways. For example, the system will not allow you to delete a file while any application program is using it. This is prevented because when the file was opened, the system obtained a lock on the file. The delete file operation also attempts to get a lock on the file and is unsuccessful because the program using the file still has the lock from when the file was opened, and the locks conflict.

When you write a high-level language program, you should be aware of what resources are allocated for each file type. Normally, the system will perform the allocation whenever an operation is requested that requires it. For example, the resources for each file used in a program are allocated when the file is opened. If you prefer to ensure that all the resources that are needed by a program are available before the program is run, you may use the Allocate Object (ALCOBJ) CL command in the job prior to running the program. In particular, the ALCOBJ command can allocate database files and most devices.

Examples of operations that require resource allocation are:

- Open
- Acquire
- Starting a program on a remote system

The file resources that must be allocated depend on the type of file and the operation being performed. File resources consist of the following:

- Open
  - For printer and diskette files that are spooled (SPOOL(*YES)), the file resources include the file description, the specified output queue, and storage in the system for the spooled data. Because the data is spooled, the device need not be available.
  - For database files, the file resources consist of the entire file, including the file, member, data, and the associated access path.
  - For printer and diskette files that are not spooled (SPOOL(*NO)) as well as for tape files, display files, and some ICF files, the file resources include the file description and the device. For ICF files that use APPC, APPN*, or intrasystem communications, the file resources include the file description and the session resources associated with the device.
  - For save files, the file resources consist of the entire file, including the file and data.
  - For DDM files, the file resources include the file description and the session resources associated with the device.

- Acquire operation

  For display files and ICF files not using APPC/APPN, or intrasystem communications, the device is allocated as a resource. For ICF files using APPC/APPN, or intrasystem communications, resources include the session resources associated with the device.

- Starting a program on a remote system

  Session resources needed for APPC and APPN.

When allocating resources, the system waits for a predefined time if the resources are not immediately available. If the resources do not become available within the time limit, an error is generated. If you are using the ALCOBJ command, the command fails. If your program is performing a file operation, that operation fails and an error message is sent to the program message queue. You may attempt to use the error handling functions of your high-level language to try the operation again. For example, if an open operation fails because another job is using the device associated with the file, you could retry the open operation a specified number of times, in the hope that the other job would finish with the device and your program would then be able to use it.

The length of time that the system waits when allocating resources is specified on the ALCOBJ command and on the WAITFILE parameter of the CL command used to create the file. If the ALCOBJ command is used prior to running a program, then the value of the WAITFILE parameter does not matter, because the resources will be available.

The following chart describes the values allowed for the WAITFILE parameter:

Values	Definition
*IMMED	This value specifies that no wait time is allowed. An immediate allocation of the file resources is required.
*CLS	The job default wait time is used as the wait time for the file resources to be allocated.
number-of-seconds	Specify the maximum number of seconds that the program is to wait for the file resources to be allocated. Valid values are 1 through 32767 (32 767 seconds).

If your application has error handling procedures for handling device errors occurring on device files, you should specify a value of something other than *IMMED to allow the system to recover from the error. The allocation of resources requested by your program on an open or acquire operation that allows your program to recover from the error will not be successful until the system recovery procedures have been completed for the device.

Opening Files

When an application wants to use a file, it does so by referring to that file by name. The file description for that file will then control how the program and the system will interact.

An application program has an option as to how the file description is used. The program may choose to use the description as it currently exists. In this case, the system uses the file description as is, without any change. A number of parameters contained in a file description can be changed, however. Therefore, the second option the application has is to change some or all of these parameters. A change made to a file description can be permanent or temporary. Permanent changes are discussed in the *System Concepts* manual and the appropriate device manual.

Temporary changes can provide greater flexibility to the application. Temporary changes are made when the program is first establishing a path to the file by opening the file. Temporary changes can be made in one of two ways:

- By information that is specified within the program itself and which is passed as parameters on the open operation
- By using override CL commands in the input stream that is used to set up the run-time environment for the application

The ability to use the first way depends very much on which programming language is used to write the program. Some programming languages do not allow you to control the open process to any great extent. These languages do the open process more or less automatically and control what information gets passed. Other languages allow you to have greater control over the open process.

The second option can be used regardless of which programming language you use. Override CL commands are provided for each file type. By including override commands with the application, you may temporarily change the file description in a file that the program wants to use.

Both options can be used together. Some parameters can be changed by information contained in the application while others can be changed by using an override command. The same parameter may be changed from both places. The operating system follows this order when making temporary changes to a file:

1. The file description provides a base of information.
2. Change information received from the application during the open process is applied first to the base information.
3. Change information found in the override command is applied last. If the same information is changed from both places, the override has precedence.

Temporary changes are seen only by the application that causes the change to be made. The file, as seen by another application, remains unchanged. In fact, two applications may use the same file at the same time, and each may change it temporarily according to its needs. Neither application is aware the other has made a temporary change. Figure 2-1 on page 2-13 and Figure 2-2 on page 2-14 illustrate the permanent and temporary change processes.

Once an application establishes a connection between itself and the file by opening the file, it can then proceed to use the file for either input or output operations. In the case of a database file, the open process establishes a path between the application and the actual database file. For device files, a path is established between the application and the actual device, or to a spooled file if the spooling attribute is active for the device file. In all cases, the application is connected to what it wants to use, and those connections determine what input or output operations are valid. Not all operations are valid with all file types. The application must be aware of what file types it uses and then use only those operations which are valid for those types.

Detecting File Description Changes

When a program that uses externally described files is compiled, the high-level language compiler extracts the record-level and field-level descriptions for the files referred to in the program and makes those descriptions part of the compiled program. When you run the program, you can verify that the descriptions with which the program was compiled are the current descriptions.

The system assigns a unique level identifier for each record format when the file it is associated with is created. The system uses the following information to determine the level identifier:

- Record format name
- Field name
- Total length of the record format
- Number of fields in the record format
- Field attributes (for example, length and decimal positions)
- Order of the field in the record format

Display, printer, and ICF files may also use the number of and order of special fields called indicators to determine the level identifier.

If you change the DDS for a record format and change any of the items in the preceding list, the level identifier changes.

To check the record format identifiers when you run the program, specify LVLCHK(*YES) on the create or change file commands.

The level identifiers of the file opened and the file description that is part of the compiled program are compared when the file is opened and LVLCHK(*YES) is specified. The system does a format-by-format comparison of the level identifiers. If the identifiers differ or if any of the formats specified in the program do not exist in

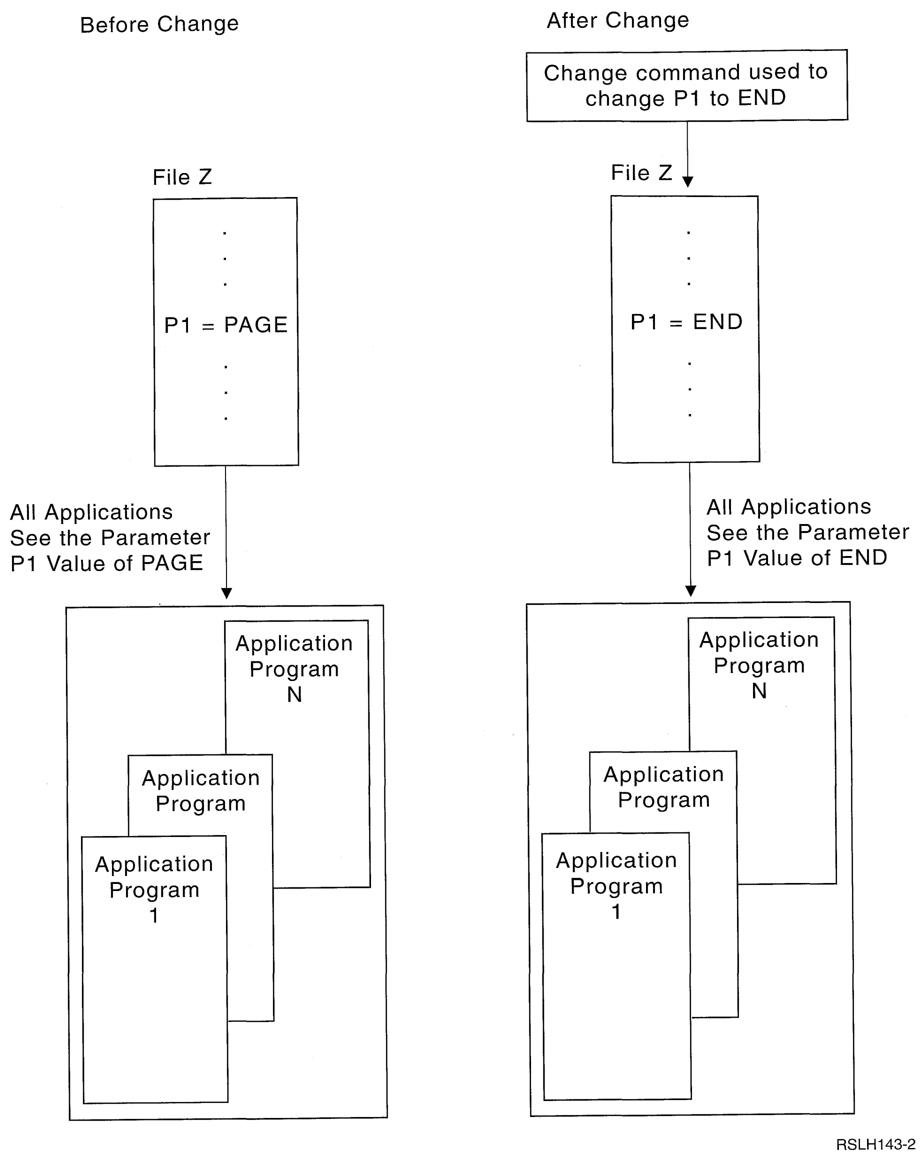


Figure 2-1. Permanently Changing a File

the file, a message is sent to the program to identify the condition.

When the identifiers differ, this means that the file format has changed. If the changes affect a field that your program uses, you must compile the program again for it to run properly. If the changes do not affect the fields that your program uses, you can run the program without compiling again by entering an override command for the file and specifying LVLCHK(*NO). Specifying LVLCHK(*NO) causes the system to omit the level identifier check when the file is opened. For example, a field is added to the end of a record format in a database file, but the program does not use the new field. You can enter the Override with Database File (OVRDBF) command with LVLCHK(*NO) to enable the program to run without being compiled again.

There are several CL commands available to you to check the changes. You can use the Display File Field Description (DSPFFD) command to display the record-level and field-level descriptions or, if you have the source entry utility (SEU), you can display the source file containing the DDS for the file. The format level identifier defined in the file can be displayed by the Display File Description (DSPFD) or the DSPFFD commands. The format level identifier which was used when the program was created can be displayed by the Display Program References (DSPPGMREF) command.

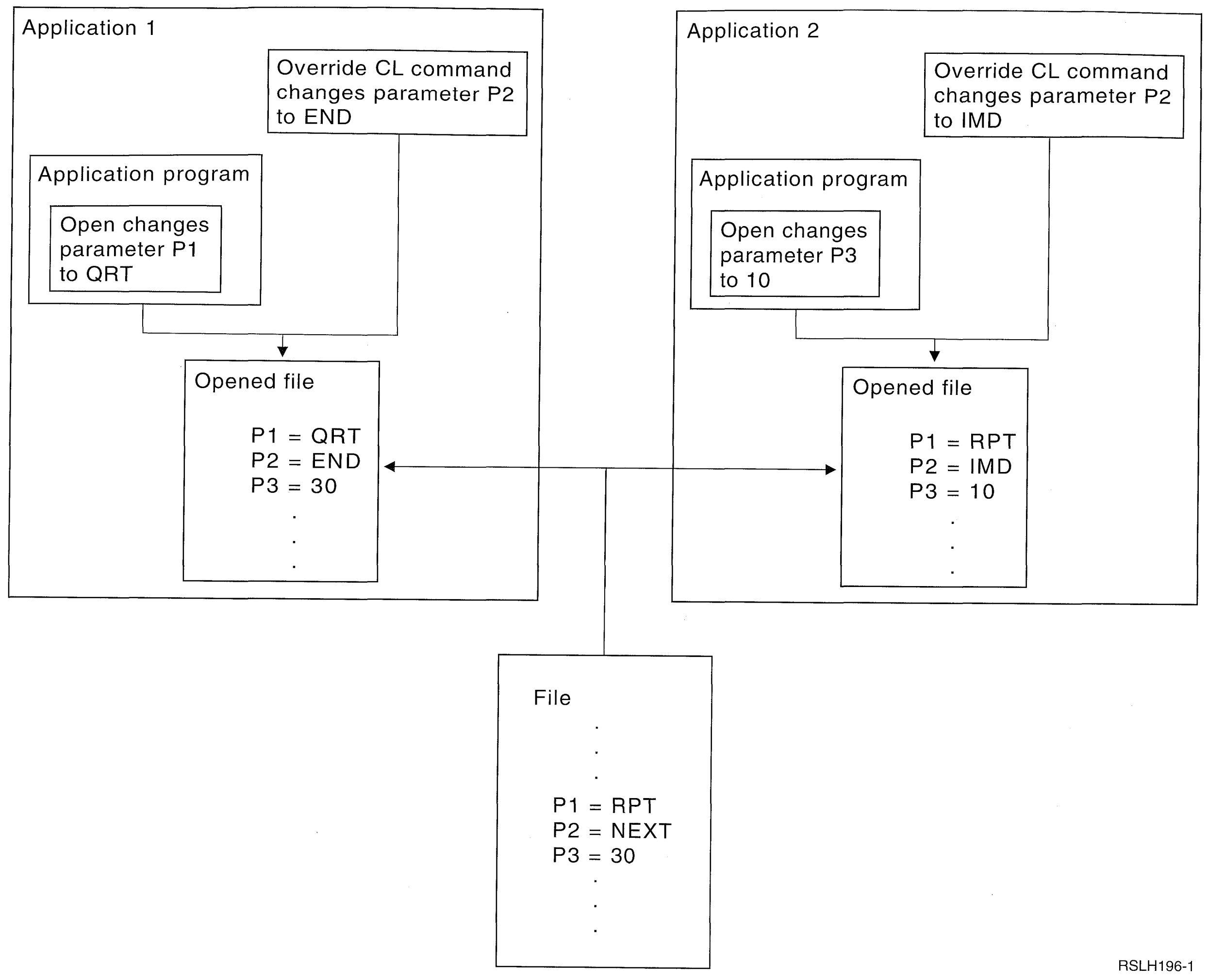


Figure 2-2. Temporarily Changing a File

There are also some changes to a file description that will not cause an error when the file is opened. These happen because the record format identifiers did not change or because your program does not use the changed formats. Formats can be added to or removed from a file without affecting existing programs that do not use the added or deleted formats.

Even though the level identifier does not change, some DDS functions that you add or delete could require changes in the logic of your program. You should review the functions you added or deleted to determine whether changes are required to the program logic.

Normally, the use of LVLCHK(*YES) is a good file integrity practice. The use of LVLCHK(*NO) can produce results that cannot be predicted.

Open and I/O Feedback Area

The system keeps track of the status of a file in feedback areas once it is successfully opened. As operations are performed on a file, these feedback areas are updated to reflect the latest status. These feedback areas give you greater control over applications and provide important information when errors occur.

The feedback areas are established at open time, and there is one feedback area for each open file. One exception is for shared files, which share feedback areas as well as the data path between the program and the file. For more information on shared opens, see “Sharing Files” on page 2-8.

Some high-level languages on the system allow you to access the status and other information about the file against which operations are being performed. There are two feedback areas of interest to you:

- Open feedback area

  This area contains information of a general nature about the file after it has been successfully opened. Examples include the name and library of the file and the file type. See “Open Feedback Area” on page A-1 for a complete list of the information that can be retrieved from the open feedback area. In addition to general information about the file, file-specific information is also contained in the open feedback area after the file is opened. The applicable fields depend on the file type.

  The open feedback area also contains information about each device or communications session defined for the file.

- Input/output feedback area

  There are two sections of the I/O feedback area:

  – Common area

    This area contains information about I/O operations that were performed on the file, including the number of operations and the last operation. See “I/O Feedback Area” on page A-11 for a complete list of the information that can be retrieved from the common I/O feedback area.

  – File-dependent feedback area

    This area contains file-specific information for display, database, printer, and ICF files, for example, the major and minor return code and amount of data received from the device. See “I/O Feedback Area for ICF and Display Files” on page A-15, “I/O Feedback Area for Printer Files” on page A-18, and “I/O Feedback Area for Database Files” on page A-18 for a complete list of the information that can be retrieved from the file-dependent I/O feedback area.

The above information areas can be useful to you. For example, when an error occurs with a device file, the program could determine predefined error handling operations based on the major/minor return code in the file-dependent feedback area. If data is being received from a communications device and the application on the other end sends an error, the program could determine that the next operation should be to wait until the next block of data is sent indicating the error. Possibly, the next operation may be to close the file and end the conversation with the application on the other side or wait for the next request from the application.

Another way might include detecting what type of file was actually opened to determine the type of operations that are allowed. If the file type is printer, only output operations would be allowed.

Error Handling

This section describes error conditions that an application program may encounter during its operation and the provisions that can be made within the program itself to attempt to deal with these conditions. The *CL Programmer’s Guide* discusses how to use the debug functions to resolve unexpected errors encountered in the application programs. The chapter on handling problems in the *Operator’s Guide* describes the programs that are available for analyzing and reporting system errors and hardware failures.

Errors can be detected when a file is opened, when a program device is acquired or released, during I/O operations to a file, and when the file is closed. When appropriate, the system will automatically try to run a failing operation again, up to a retry limit. When a retry is successful, neither operator nor program action is required. Errors that can affect the processing of the program may be reported in any or all of the following ways:

- A notify, status, diagnostic, or escape message may be sent to the program message queue of the program using the file. These messages may also appear in the job log, depending on the message logging level set for the job.
- A file status code may be returned by the high-level language.
- A major/minor return code is returned in the I/O feedback area for ICF, display, and printer files.
- A notify, status, diagnostic, or escape message may be sent to the operator message queue (QSYSOPR) or the history message queue (QHST).

- Information regarding the error may be saved in the system error log for use by the problem analysis and resolution programs.
- An alert message may be sent to an operator at another system in the network.
- The normal program flow may be interrupted and control may be transferred to an error-handling subroutine, or other language operations may occur. For additional information about how to handle run-time errors, see the appropriate high-level language manual.

Only some of these are significant to a program that is attempting error recovery.

Not all file errors allow programmed error recovery. Some errors are considered permanent; that is, the file, device, or program cannot work until some corrective action is taken. This might involve resetting the device by varying it off and on again, or correcting an error in the device configuration or the application program. Some messages and return codes are used to inform the user or the application program of conditions that are information rather than errors, such as change in the status of a communications line, or system action taken for an unexpected condition. In many cases, it is possible for the application program to test for an error condition and take some preplanned recovery action which allows the program to continue without intervention from the operator.

Messages and Message Monitors

Displayed messages are the primary source of information for an operator or a programmer who is testing a new application. A message usually contains more specific information than the file status code, the indicators, or the major/minor return code. The control language allows messages to be monitored so that the CL program can intercept a message and take corrective action. See the *CL Programmer's Guide* for more information about message types and message monitors. In most high-level languages, either the file status code or major/minor return code (described in the following section) is a more convenient source of information.

Message numbers are assigned in categories to make it easier for a program to monitor for any of a group of related messages. Table 2-5 shows the message number ranges assigned for file error messages.

Table 2-5. OS/400 Data Management Message Number Ranges

Message IDs	Operation	Message Type
CPF4001–40FF	Open	Diagnostic and status.
CPF4101–43FF	Open	Escapes that make the file unusable.
CPF4401–44FF	Close	Diagnostic and status.
CPF4501–46FF	Close	Escapes that make the file unusable.
CPF4701–48FF	I/O, Acquire, and Release	Notify with a default reply of cancel, status and escapes that do not make the file or device unusable.
CPF4901–49FF	I/O, Acquire, and Release	Notify with a default reply of ignore or go.
CPF5001–50FF	I/O, Acquire, and Release	Notify with a default reply of cancel.
CPF5101–53FF	I/O, Acquire, and Release	Escapes that make the file or device unusable.
CPF5501–56FF	I/O, Acquire, and Release	Escapes that make the file or device unusable.

Some status messages, CPF4018 for example, are preceded by a diagnostic message that provides additional information. Diagnostic messages may be kept in the job log, depending on the message logging level of the job. If a CL program monitors for CPF4018, CPF5041, or similar messages, it can retrieve the accompanying diagnostic message from the program message queue.

If an error occurs for which an escape message is issued and the message is not monitored, your program will be ended and the message displayed for the operator. Status messages may also be monitored, but if they are not monitored, the program continues. Most high-level languages except CL monitor for all the file errors that are likely to be encountered, and provide some standard recovery. Depending on the severity of the error, the high-level language may simply end the program and issue a message of its own. Alternatively, the application programmer may code an error recovery routine to handle errors that are anticipated in that particular application.

Within these error-handling routines, it is usually necessary to examine the file status or major/minor return codes to determine the cause of the error. The manuals for the language you are using explain how to access file status and major/minor return codes. The language manuals also explain the file status codes as they are defined for each language.

Major/Minor Return Codes

Major/minor return codes are used to report errors and certain status information for ICF, display, and printer files. They are not used for other files. They are usually stated as four characters: the first two referring to the major code and the second two referring to the minor code. The major code indicates the general type of error, and the minor provides further detail. Minor codes, except zero, have the same or a similar meaning, regardless of the major code with which they are combined.

The application program can test the return code after each I/O operation. If the major return code is 00, the operation completed successfully and the minor return code contains status information that indicates whether a read or a write operation should be performed next. A major return code of 04 or above indicates that an error occurred. The program may test for any specific errors for which programmed recovery is attempted. The application program may test for a specific condition by comparing the major and minor codes as a unit, or may identify a class of conditions by testing the major code alone.

Most major/minor return codes are accompanied by any one of several message numbers, for which the typical recovery action is similar. File status codes are defined by the individual languages and may be set based on the major/minor return codes.

Table 2-6 defines the major return codes. See the *Guide to Programming Displays* for specific definitions of the major and minor return codes as they are used for display files and the message numbers associated with each. Similar specific definitions for printer files and each of the communications types valid on an ICF file can be found in the *Guide to Programming for Printing* and manuals for each communications type.

Table 2-6. Major Return Code Definitions

Code	Definition
00	The operation requested by your program completed successfully. The minor includes state information, such as change direction.
02	Input operation completed successfully, but job is being ended (controlled). The minor includes state information.
03	Successful input operation, but no data was received. The minor includes state information.
04	Error occurred because an output operation was attempted while data was waiting to be read.
08	An acquire operation failed because the device has already been acquired or the session has already been established.
11	A read-from-invited-program-devices operation failed because no device or session was invited.
34	An input exception occurred. The data length or record format was not acceptable for the program.
80	A permanent (unrecoverable) system or file error occurred. Programmer action is required to correct the problem.
81	A permanent (unrecoverable) device or session error occurred during an I/O operation.
82	A device or session error occurred during an open or acquire operation. Recovery may be possible.
83	A device or session error occurred during an I/O operation. Recovery may be possible.

Actions for Error Recovery

The following sections describe the error recovery action that is appropriate for each group of major return codes.

Normal Completion: A major/minor return code of 0000 indicates that the operation requested by your program was completed successfully. Most of the time, no message is issued. In some cases, a diagnostic message might be used to inform the user of some unusual condition that the system was able to handle, but which might be considered an error under some conditions. For example, a parameter that is not valid might be ignored, or some default action taken.

For communications devices, a major return code of 00, indicating successful completion with data received, is accompanied by a minor return code that indicates what operation the application program is expected to perform next. The nonzero minor does not indicate an error. No message is issued.

Completion with Exceptions: Several rather specific major return codes have been assigned to conditions for which a specific response from the application program is appropriate.

A major return code of 02 indicates that the requested input operation completed successfully, but the job is being ended (controlled). The application program should complete its processing as quickly as possible. The controlled cancel is intended to allow programs time to end in an orderly manner. If your program does not end within the time specified on the ENDJOB command, the job will be ended by the system without further notice.

A major return code of 03 indicates that an input operation completed successfully without transferring any data. For some applications, this might be an error condition, or it might be expected when the user presses a function key instead of entering data. It might also indicate that all the data has been processed, and the application program should proceed with its completion processing. In any case, the contents of the input buffer in the program should be ignored.

A major/minor code of 0309 is used to indicate that no data was received *and* the job is being ended (controlled). A major/minor code of 0310 indicates that there is no data because the specified wait time has ended. Other minor return codes accompanying the 02 or 03 major code are the same as for a 00 major code, indicating communications status and the operation to be performed next.

A major return code of 04 indicates that an output exception occurred. Specifically, your program attempted to send data when there was data waiting to be received. This is probably the result of not handling the minor return code properly on the previous successful completion. Your program can recover by simply receiving the incoming data and then repeating the write operation.

A major return code of 34 indicates that an input exception occurred. The received data was either too long or incompatible with the record format. The minor return code indicates what was wrong with the received data, and whether the data was truncated or rejected. Your program can probably handle the exception and continue. If the data was rejected, you may be able to read it by specifying a different record format.

Two other return codes in this group, 0800 and 1100, are both usually the result of application programming errors, but are still recoverable. 0800 indicates that an acquire operation failed because the device has already been acquired or the session has already been established. 1100 indicates that the program attempted to read from invited devices with no devices invited. In both cases, the request that is not valid is ignored, and the program may continue.

No message is issued with a 02 major code or most minor codes with the 03 major code, but the other exceptions in this group are usually accompanied by a message in the CPF4701–CPF47FF or CPF5001–CPF50FF range.

Permanent System or File Error: A major return code of 80 indicates a serious error affecting the file. The application program must close the file and reopen it before attempting to use it again, but recovery is unlikely until the problem causing the error is found and corrected. To reset an error condition in a shared file by closing it and opening it again, all programs sharing the open data path must close the file. This may require returning to previous programs in the call stack and closing the shared file in each of those programs. The operator or programmer should refer to the text of the accompanying message to determine what action is appropriate for the particular error.

Within this group, several minor return codes are of particular interest. A major/minor code of 8081 indicates a serious system error for which an APAR probably will be required. The message sent with the major/minor return code may direct you to run the Analyze Problem (ANZPRB) command to obtain more information.

A major/minor code of 80EB indicates that incorrect or incompatible options were specified in the device file or as parameters on the open operation. In most cases you can close the file, end the program, correct the parameter that is not valid with an override command, and run the program again. The override command affects only the job in which it is issued. It allows you to test the change easily, but you may eventually want to change or re-create the device file as appropriate to make the change permanent.

Permanent Device or Session Error on I/O Operation: A major return code of 81 indicates a serious error affecting the device or session. This includes hardware failures affecting the device, communications line, or communications controller. It also includes errors due to a device being disconnected or powered off unexpectedly and abnormal conditions that were discovered by the device and reported back to the system. Both the minor return code and the accompanying message provide more specific information regarding the cause of the problem.

Depending on the file type, the program must either close the file and open it again, release the device and acquire it again, or acquire the session again. To reset an error condition in a shared file by closing it and opening it again, all programs sharing the open data path must close the file. In some cases, the message may instruct you to reset the device by varying it off and on again. It is unlikely that the program will be able to use the failing device until the problem causing the error is found and corrected, but recovery within the program may be possible if an alternate device is available.

Some of the minor return codes in this group are the same as those for the 82 major return code. Device or line failures may occur at any time, but an 81 major code occurs on an I/O operation. This means that your program had already established a link with the device or session. Therefore, some data may have been transferred, but when the program is started again, it starts from the beginning. A possible duplication of data could result.

Message numbers accompanying an 81 major code may be in the range indicating either an I/O or a close operation. A device failure on a close operation simply may be the result of a failure in sending the final block of data, rather than action specific to closing the file. An error on a close operation may result in the file being left partially closed. Your error recovery program should respond to close failures with a second close operation. The second close will always complete, regardless of errors.

Device or Session Error on Open or Acquire Operation: A major return code of 82 indicates that a device or session error occurred during an open or acquire operation. Both the minor return code and the accompanying message will provide more specific information regarding the cause of the problem.

Some of the minor return codes in this group are the same as those for the 81 major return code. Device or line failures may occur at any time, but an 82 major code indicates that the device or session was unusable when your program first attempted to use it. Thus no data was transferred. The problem may be the result of a configuration or installation error.

Depending on the minor return code, it may be appropriate for your program to recover from the error and try the failing operation again after some waiting period. The number of times you try should be specified in your program. It may also be possible to use an alternate or backup device or session instead.

Message numbers accompanying an 82 major code may be in the range indicating either an open or an acquire operation. If the operation was an open, it is necessary to close the partially opened file and reopen it to recover from the error. If the operation was an acquire, it may be necessary to do a release operation before trying the acquire again. In either case, the file wait time should be specified long enough to allow the system to recover from the error.

Recoverable Device or Session Errors on I/O Operation: A major return code of 83 indicates that an error occurred in sending data to a device or receiving data from the device. Recovery by the application program is possible. Both the minor return code and the accompanying message provide more specific information regarding the cause of the problem.

Most of the errors in this group are the result of sending commands or data that are not valid to the device, or sending valid data at the wrong time or to a device that is not able to handle it. The application program may recover by skipping the failing operation or data item and going on to the next one, or by substituting an appropriate default. There may be a logic error in the application.

Related Information on File Types

Refer to the following manuals for more information on the file types discussed in this chapter:

- Database files: *Database Guide*
- Display files: *Guide to Programming Displays*
- DDM files: *DDM Guide*
- ICF files: *ICF Programmer's Guide*
- Printer files: *Guide to Programming for Printing*
- Save files: *Advanced Backup and Recovery Guide*
- Tape and diskette files: *Guide to Programming for Tape and Diskette*

Chapter 3. Overrides and File Redirection

This chapter contains Product-Sensitive Programming Interface and Associated Guidance Information.

Overrides are used to temporarily change a file name, a device name or remote location name associated with the file, or some of the other attributes of a file. Override commands may be entered interactively from a display station or as part of a batch job. They may be included in a control language (CL) program, or they may be issued from other programs by calling the program QCMDEXC. Regardless of how they are issued, overrides remain in effect only for the job, program, or display station session in which they are issued. Furthermore, they have no effect on other jobs that may be running at the same time.

Overrides are particularly useful for making minor changes to the way a program functions or for selecting the data on which it operates, without having to recompile the program. Their principal value is in allowing you to use general purpose programs in a wider variety of circumstances. Examples of items where overrides may be used are:

- Changing the name of the file to be processed
- Selecting the database file member to be processed
- Indicating whether output is to be spooled
- Directing output to a different tape unit
- Changing printer characteristics such as lines per inch and number of copies
- Selecting the remote location to be used with an ICF file
- Changing the characteristics of a communications session

It is also possible to use overrides to direct data input or output to a device of a different type; for example, to send data that was intended for a diskette to a printer instead. This use of overrides requires somewhat more foresight than the override applications listed above, because the program must be able to accommodate the different characteristics of the two devices involved. The special considerations required for overrides that change the file type are discussed in "File Redirection" on page 3-17.

There are two types of overrides:

- **File overrides** (where you override file names or the attributes of a file).
- **Program device entry overrides** (where you override the attribute of an ICF file that provides the link between the application and each of the remote systems or devices with which your program communicates).

Overriding Files

When you create an application program, files are associated with it by the file names specified in the program. The system lets you override these file names or the attributes of the specified file when you compile a program or run a program. The system supplies three override functions: applying overrides, deleting overrides, and displaying overrides. You can process override functions for files using the following CL commands:

DLTOVR
: Delete Override: Deletes one or more file overrides (including message file overrides) that were previously specified in a call level.

DSPOVR
: Display Override: Displays file overrides at any active call level for a job.

OVRDBF
: Override with Database File: Overrides (replaces) the database file named in the program, overrides certain parameters of a database file that is used by the program, or overrides the file and certain parameters of the file to be processed.

OVRDKTF
: Override with Diskette File: Overrides (replaces) the diskette file named in the program, overrides certain parameters of a diskette file that is used by the program, or overrides the file and certain parameters of the file to be processed.

OVRDSPF
: Override with Display File: Overrides (replaces) the display file named in the program, overrides certain parameters of a display file that is used by the program, or

overrides the file and certain parameters of the file to be processed.

OVRICFF
: Override with Intersystem Communications Function File: Used to override the file named in the program and override certain parameters of the file being processed.

OVRMSGF
: Override with Message File: Used to override a message file used in a program. The rules for applying the overrides in this command are different from the other override commands. For more information on overriding message files, see the *CL Programmer's Guide*.

OVRPRTF
: Override with Printer File: Overrides (replaces) the printer file named in the program, overrides certain parameters of a printer file that is used by the program, or overrides the file and certain parameters of the file to be processed.

OVRSAVF
: Override with Save File: Overrides (replaces) the file named in the program, overrides certain attributes of a file that is used by the program, or overrides the file and certain attributes of the file to be processed.

OVRTAPF
: Override with Tape File: Overrides (replaces) the file named in the program, overrides certain attributes of a file that is used by the program, or overrides the file and certain attributes of the file to be processed.

Overrides may be used to change most, but not all, of the file attributes that are specified when the file is created. In some cases, attributes may be specified in overrides that are not part of the original file definition. Refer to the command descriptions in the *CL Reference* manual for details.

Override commands can be scoped to either the call level (the default) or to the job level. For an explanation of call levels and the job level, see "Job Level and Call Levels with Override Commands" on page 3-4. Overrides that are scoped to the call level remain in effect from the time they are specified until they are replaced, or deleted, or until the program in which they are specified ends. Overrides that are scoped to the job level remain in effect from the time they are specified until they are replaced, or deleted, or until the job in which they are specified ends.

Overrides applied include any that are in effect at the time a file is opened by an application program, when a program that opens a file is compiled, or when certain system commands are used. (See "Applying Overrides When Using High-Level Language Programs," "Applying Overrides When Compiling a Program" on page 3-11 , and "Effect of Overrides on Some System Commands" on page 3-12). Thus any overrides that are to be applied must be specified either before the file is opened by a program or before a program that opens the file is compiled. It is not necessary that overrides be supplied for every file used in a program. Any file name for which no override is supplied is used as the actual file name.

Overriding a file is different from changing a file in that an override does not permanently change the attributes of a file. For example, if you override the number of copies for a printer file by requesting six copies instead of two, the file description for the printer file still specifies two copies, but six copies are printed. The system uses the file override command to determine which file to open and/or what its file attributes are.

Handling overrides for message files is different in some respects from handling overrides for other files. Only the name of the message file, not the attributes, can be overridden. For more information on message handling, refer to the *CL Programmer's Guide*.

Applying Overrides When Using High-Level Language Programs

There are three different types of file overrides. These are discussed in the following sections.

Overriding File Attributes: The simplest form of overriding a file is to override some attributes of the file. File attributes are built as a result of the following:

- Create file and add member commands. Initially, these commands build the file attributes.
- Program using the files. At compile time, the user program can specify some of the file

attributes. (The attributes that can be specified depend on the high-level language in which the program is written.)

- Override commands. At program run time, these commands can override the file attributes previously built by the merging of the file description and the file parameters specified in the user program.

For example, assume that you create a printer file OUTPUT whose attributes are:

- Page size of 60 by 80
- Six lines per inch
- Two copies of printed output
- Two pages for file separators
- Overflow line number of 55

The Create Printer File (CRTPRTF) command looks like this:

```
CRTPRTF FILE(QGPL/OUTPUT) SPOOL(*YES) +
  PAGESIZE(60 80) LPI(6) COPIES(2) +
  FILESEP(2) OVRFLW(55)
```

The printer file OUTPUT is specified in your application program with an overflow line number of 58 and a page size of 66 by 132.

However, before you run the application program, you want to change the number of copies of printed output to 3 and the overflow line to 60. The override command looks like this:

```
OVRPRTF FILE(OUTPUT) COPIES(3) OVRFLW(60)
```

Then you call the application program, and three copies of the output are printed.

When the application program opens the OUTPUT file, the file-specified attributes, program-specified attributes, and override-specified attributes are merged to form the open data path. The open data path is used when the program is run. The file-specified overrides are merged with the program-specified attributes first. Then these merged attributes are merged with the override attributes. In this example, when the OUTPUT file is opened and output operations are performed, spooled output will be produced with a page size of 66 by 132, six lines per inch, three copies, two file separator pages, and overflow at 60 lines.

Figure 3-1 explains this example.

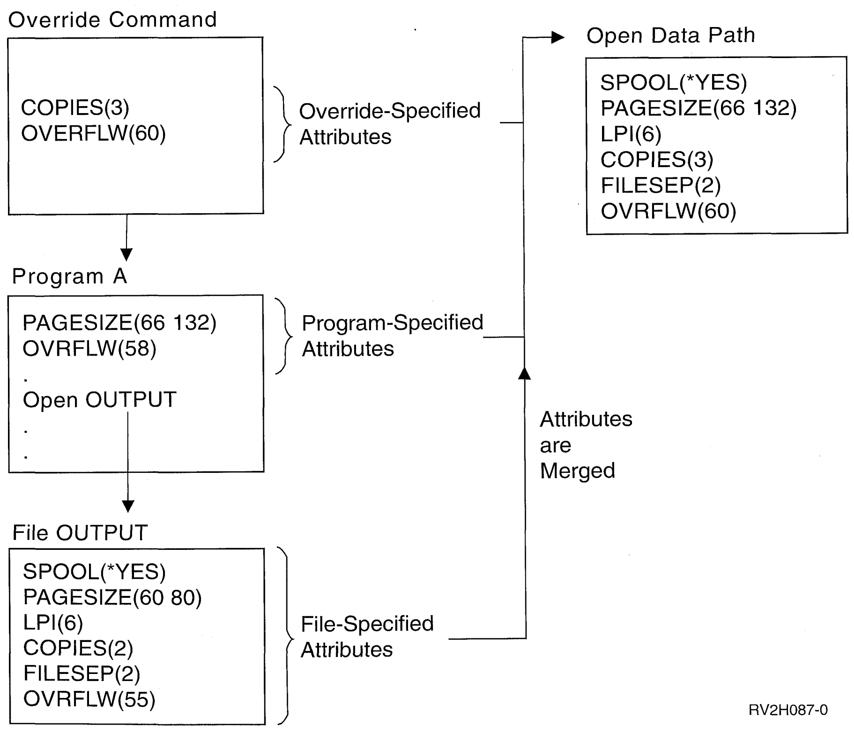


Figure 3-1. Overriding File Attributes

Overriding File Names or Types: Another simple form of overriding a file is to change the file that is used by the program. This may be useful for files that have been moved or renamed after the program has been compiled.

For example, you want the output from your application program to be printed using the printer file REPORTS instead of the printer file OUTPUT (OUTPUT is specified in the application program). Before you run the program, enter the following:

```
OVRPRTF FILE(OUTPUT) TOFILE(REPORTS)
```

The file REPORTS must have been created by a CRTPRTF command before it can be used.

If you want to override to a different type of file, you use the override command for the new type of file. For example, if you are overriding a diskette file with a printer file, use the Override with Printer File (OVRPRTF) command.

Use the information under "File Redirection" on page 3-17 to determine if files can be overridden to another type of file.

Overriding File Names or Types and File Attributes of the New File: This form of overriding files is simply a combination of overriding file attributes and overriding file names or types. With this form of override, you can override the file that is to be used in a program and you can also override the attributes of the overriding file. For example, you want the output from your application program to be printed using the printer file REPORTS instead of the printer file OUTPUT (OUTPUT is specified in the application program). In addition to having the application
| program use the printer file REPORTS, you want
| to override the number of copies produced to three. Assume the file REPORTS was created with the following command:

```
CRTPRTF FILE(REPORTS) SPOOL(*YES) +
  PAGESIZE(68 132) LPI(8) OVRFLW(60) +
  COPIES(2) FILESEP(1)
```

Before you run the program, type the following command:

```
OVRPRTF FILE(OUTPUT) TOFILE(REPORTS) COPIES(3)
```

Then call the application program, and three copies of the output are produced using the printer file REPORTS.

Note that this is *not* equal to the following two override commands:

Override 1 `OVRPRTF FILE(OUTPUT) TOFILE(REPORTS)`
Override 2 `OVRPRTF FILE(REPORTS) COPIES(3)`

Only one override is applied for each call level for an open of a particular file, so if you want to override the file that is used by the program and also override the attributes of the overriding file from one call level, you must use a single command. If two overrides are used, override 1 will cause the output to be printed using the printer file REPORTS, but override 2 will be ignored.

| Job Level and Call Levels with | Override Commands

| Override commands can be scoped to the call
| level (the default) or to the job level. A **job** is a
| piece of work to be done by the system. An **inter-**
| **active job** begins when a user signs on and ends
| when a user signs off. In Figure 3-2 on page 3-5,
| the job encompasses the job level and the pro-
| grams running in call levels 1 to 3. Overrides
| scoped to the job level remain in effect until they
| are deleted, replaced, or until the job in which they
| are specified ends. This is true regardless of the
| call level in which the overrides were specified.
| For example, an override that is issued in call
| level 3 that is scoped to the job level remains in
| effect when call level 3 is deleted.

| Overrides can be scoped to the job level by speci-
| fying OVRSCOPE(*JOB) on the override
| command.

Call levels identify the subordinate relationships
| between related programs when one program is
| called from another program within a job. For
example:

```
Job
Job Level     xxxxxx

Call Level 1  PGM A
              xxxxxx
              CALL PGM B

Call Level 2     PGM B
                 xxxxxx
                 TFRCTL PGM C

                 PGM C
                 xxxxxx
                 CALL PGM D

Call Level 3        PGM D
                    xxxxxx
                    RETURN
```

Figure 3-2. Levels within a Job

Several commands, such as Work with Job (WRKJOB), Work with Active Jobs (WRKACTJOB), or Display Job (DSPJOB), have options that allow you to display the call stack of an active job. There is a one-to-one relationship between a program displayed in the call stack and the call level for that program. The first program name displayed (at the top of the list) on the call stack is the program at call level 1 for that job. Call level 1 is the lowest call level for a job. The second program name displayed is the program at call level 2 for that job. The last program name displayed is the program at the highest call level for that job.

In the previous example, the TFRCTL to PGMC causes PGMB to be removed from the call stack and replaced by PGMC. A CALL command causes another program to be placed in the call stack. A RETURN command causes a program to be removed from the stack.

Specific examples of each override can be found throughout this chapter. The job level and call levels affect override processing by the following general principles.

- Override commands that are scoped to the job level remain in effect until they are replaced, deleted, or until the job in which they are specified ends. For more information on deleting overrides, see "Deleting Overrides" on page 3-12.
- There can be only one active override for a file at the job level. If more than one override for the same file is scoped to the job level, the most recent one is active.
- Override commands that are scoped to the job level apply to all programs that are running in the job regardless of the call level in which the overrides are specified.
- An override command (scoped to the call level) entered interactively exists at the call level of the caller of that command processor. For example, an override (scoped to the call level) entered on the command entry display cannot be deleted or replaced from a command processor called from the command entry display.
- The call level of an override (scoped to the call level) coded in a CL program is the call level of the CL program.
- An override (scoped to the call level) outside a program in a batch job takes the call level of the batch job command processor.
- If an override command (scoped to the call level) is run using a call to the QCMDEXC program, the override takes the call level of the program that called the QCMDEXC program. For an example, see "CL Program Overrides" on page 3-9.
- Exits (ENDPGM, RETURN, or abnormal exits) from a call delete overrides scoped to that call level. However, they do not delete overrides issued in that call level that are scoped to the job level. For example, a RETURN command deletes all overrides scoped to that call level. Thus, overrides scoped to the call level in called programs that end with a RETURN or ENDPGM command do not apply to the calling program. This is not true for programs using the Transfer Control (TFRCTL) command.

  In Figure 3-3 on page 3-6, the RETURN command deletes the first override in program B, and FILE X is opened in program A. However, the RETURN command does not delete the second override because it is scoped to the job level. FILE B is opened in program A when program A processes the Open FILE A command.

```
                 Program A
                   :
                 CALL PGM(B)

                   Program B
Override 1         OVRDBF FILE(X) FILE(Y)
Override 2         OVRDBF FILE(A) TOFILE(B) +
                     OVRSCOPE(*JOB)
                     :
                   RETURN

                 OPEN FILE X
                   :
                 OPEN FILE A
```

Figure 3-3. Job Level and Call Level Overrides

- The TFRCTL command causes one program to be replaced by another program at the same call level. The program, to which control is transferred, runs at the same call level as the program that contained the TFRCTL command. An override command in a program that transfers control to another program is not deleted during the transfer of control.

  In Figure 3-4, override 2 in program A is applied to the open file operation in program C because the TFRCTL command keeps the call level. FILE Y is opened. Override 1 in program B is deleted when the RETURN statement is processed. For another example, see "Applying Overrides at the Same Call Level" on page 3-7.

```
                 Program A
                   :
                 CALL PGM(B)

                   Program B
Override 1         OVRDBF FILE(Y) FILE(Z)
                     :
                   RETURN

Override 2       OVRDBF FILE(X) TOFILE(Y)
                 TFRCTL PGM(C)
                   :

                 Program C
                   :
                 OPEN FILE(X)
```

Figure 3-4. Overrides With the TFRCTL Command

- Several overrides (possibly one per call level and possibly one at the job level) to a single file are allowed. They are applied by the system in inverse call level order; any applicable overrides at the job level are applied last.

  For an example of applying overrides in inverse call level order, see "Applying Overrides from Multiple Call Levels" on page 3-7.

- You can protect an override from being overridden by overrides at lower call levels and the job level by coding SECURE(*YES) on it. For an example, see "Securing Files" on page 3-9.

- When overrides are applied, only one override can be used from a call level or the job level for any particular file. If two or more overrides for the same file are requested at the same call level or job level, the last override makes the others obsolete. This is true even if the override involves a name change, as the following example illustrates. It is really one file that is being overridden, and therefore only one override is allowed at each level.

  In the following example, when the program attempts to open FILE A, FILE A is overridden with FILE B because of override 2. Because only one override can be applied for each call level, override 1 is ignored, and the file opened by the program is FILE B.

```
                 Program A
                   :
Override 1       OVRDBF FILE(B) TOFILE(C)
Override 2       OVRDBF FILE(A) TOFILE(B)
                   :
                 OPEN FILE A
                   :
```

To open FILE C, replace the two Override with Database File (OVRDBF) commands with the following command:

```
OVRDBF FILE(A) TOFILE(C)
```

This does not prevent applying an override at the same call level or job level in which the file is created. File attributes on the override take the place of corresponding attributes on the file create statement, regardless of which is encountered first.

For another example, see "Applying Overrides at the Same Call Level" on page 3-7.

Applying Overrides at the Same Call Level: The TFRCTL command causes one program to be replaced by another program at the same call level. The program, to which control is transferred, runs at the same call level as the program that contained the TFRCTL command. An override command in a program that transfers control to another program is not deleted during the transfer of control. In the following example, program A transfers control to program B, and program B runs in the same call level as program A. The Override with Database File (OVRDBF) command causes the file to be positioned at the last record of the member when it is opened and is used for both programs A and B.

```
CALL PGM(A)
```

Program A

```
OVRDBF FILE(INPUT) POSITION(*END)
```

(INPUT is opened and positioned at the last record of the member and closed after processing.)

```
TFRCTL PGM(B)
```

Program B

(INPUT is opened and positioned at the last record of the member.)

When two overrides are entered for the same file name at the same call level, the second override replaces the first override. This allows you to replace an override at a single call level, without having to delete the first override (see "Deleting Overrides" on page 3-12). For example:

```
Override 1   OVRDKTF FILE(QDKTSRC) LABEL(X)
             CALL PGM(REORDER)

Override 2   OVRDKTF FILE(QDKTSRC) LABEL(Y)
             CALL PGM(REORDER)
```

Assume that program REORDER uses the diskette file QDKTSRC. Override 1 causes the first call to program REORDER to use the source file with a label of X for its processing. Override 2 causes the second call to program REORDER to use the source file with a label of Y for its processing.

Applying Overrides from Multiple Call Levels: When you have more than one override for the same file at several levels (possibly one per call level and possibly one at the job level), the overrides are applied to the file in inverse call level order. Any applicable overrides at the job level are applied last.

If any overrides are scoped to the job level, the final authority for any attribute is the job level. If no overrides are scoped to the job level, the final authority for any attribute is the lowest call level which specifies that attribute.

For example, a user at a display station (call level 1) calls a CL program (call level 2) which then calls an RPG program (call level 3). Any attributes overridden in call level 3 are applied first, any overrides in call level 2 are applied second, any overrides in call level 1 are applied third, and any overrides at the job level are applied last. Attributes that are not overridden are taken from the RPG program, or finally, from the device file or database file.

To prevent file overrides at lower call levels, see "Securing Files" on page 3-9.

In this example, override 1 is issued in call level 1, override 2 is issued in call level 2, and override 3 is issued in call level 3.

```
Override 1   OVRPRTF FILE(OUTPUT) COPIES(6) +
               SPOOL(*YES)
             CALL PGM(A)

               Program A
Override 2     OVRPRTF FILE(OUTPUT) COPIES(2) +
                 LPI(6) OVRSCOPE(*JOB)
               CALL PGM(B)

                 Program B
Override 3       OVRPRTF FILE(OUTPUT) CPI(10)
                 CALL PGM(C)
```

When program C opens the file OUTPUT, the opened file has the following attributes:

COPIES(2)	From Override 2
SPOOL(*YES)	From Override 1
LPI(6)	From Override 2
CPI(10)	From Override 3

The attribute of COPIES(6) specified in override 1 (call level 1) is not used because override 2 is scoped to the job level. Therefore, COPIES(2) takes precedence.

In this example, override 1 is issued in call level 1; override 2 is issued in call level 2.

```
Override 1   OVRDBF FILE(PAYROLL) MBR(CURRENT)
             CALL PROG1

                Program PROG1
Override 2      OVRDBF FILE(INPUT) TOFILE(PAYROLL)
                CALL PROG2
```

When program PROG2 is ready to open INPUT, it opens PAYROLL instead (because of override 2). Also, the member used for processing is CURRENT (because of override 1).

When several overrides that override the file type to be used by a program are applied, only the attributes specified on the overrides of the same type as the final file are applied. In the following example, assume that program MAKEMASTER attempts to open the diskette file DKA:

```
Override 1   OVRDKTF FILE(PRTA) TOFILE(DKB) +
               LABEL(DKFIRST)
             CALL PGM(A)

               Program A
Override 2     OVRPRTF FILE(DKA) TOFILE(PRTA) +
                 SPOOL(*YES)
               CALL PGM(B)

                 Program B
Override 3       OVRDKTF FILE(PRTB) TOFILE(DKA) +
                   DEV(DKT02) LABEL(DKLAST)

Override 4       OVRDKTF FILE(DKA) TOFILE(DKC) +
                   DEV(DKT02) LABEL(DKTTST)
                 CALL PGM(C)

                   Program C
Override 5         OVRPRTF FILE(DKA) +
                     TOFILE(PRTB) +
                     SCHEDULE(*JOBEND)
                   CALL PGM(D)

                     Program D
Override 6           OVRDKTF FILE(DKA) +
                       VOL(MASTER)
                     CALL PGM(MAKEMASTER)

                       Program MAKEMASTER
                       (Program
                       MAKEMASTER
                       attempts to open file
                       DKA, but actually
                       opens the diskette file
                       DKB.)
```

In the preceding example, the file that program MAKEMASTER actually opens is the diskette file DKB because of the following reasons:

- Override 6 (applied first) does not cause file DKA to be overridden with any other file.
- Override 5 (applied second) causes file DKA to be overridden with printer file PRTB.
- Override 4 is ignored at this level because override 5 changed the file name to PRTB.
- Override 3 (applied third) causes file PRTB to be overridden with diskette file DKA.
- Override 2 (applied fourth) causes file DKA to be overridden with printer file PRTA.
- Override 1 (applied last) causes file PRTA to be overridden with diskette file DKB.

Therefore, the file that program MAKEMASTER opens is the diskette file DKB. Because the file to be opened is a diskette file, the attributes overridden are only those specified on the Override with Diskette File (OVRDKTF) commands: VOL(MASTER) from override 6; DEV(DKT02) from override 3; and LABEL(DKFIRST) from override 1.

The attributes specified on the Override with Printer File (OVRPRTF) commands are ignored (even though they might have been allowed on the OVRDKTF commands). Refer to "File Redirection" on page 3-17 for more information on the effect of overrides that change the file type.

CL Program Overrides: If a CL program overrides a file and then calls a high-level language program, the override remains in effect for the high-level language program. However, if a high-level language program calls a CL program that overrides a file, the override is deleted automatically when control returns to the high-level language program.

High-level language program:

```
CALL PGM(CLPGM1)
```

CL Program CLPGM1

```
OVRDKTF FILE(DK1) TOFILE(MSTOUT)
  ⋮
ENDPGM
```

High-level language program:

```
OPEN DK1
```

The file opened is DK1, not MSTOUT. This is because the override in the CL program is deleted when the CL program ends.

To perform an override from a high-level language program, call the QCMDEXC program from the high-level language program. The override specified on the QCMDEXC command, takes the call level of the program that called QCMDEXC. High-level language program:

```
CALL QCMDEXC PARM('OVRDKTF FILE(DK1) +
  TOFILE(MSTOUT)' 32)
OPEN DK1
```

The file opened is MSTOUT because of the override requested by the call to the QCMDEXC program.

In an actual program, you might want to use data supplied by the program as a parameter of the override. This can be done by using program variables in the call to QCMDEXC. For more information on the use of program variables, refer to the appropriate language manual.

Securing Files: On occasion, you may want to prevent the person or program that calls your program from changing the file names or attributes you have specified. You can prevent additional file overrides by coding the SECURE(*YES) parameter on a file override command for each file needing protection. This protects your file from overrides at lower call levels and the job level.

The following shows an example of a protected file:

```
Override 1   OVRPRTF FILE(PRINT1) SPOOL(*NO)

Override 2   OVRDBF FILE(NEWEMP) TOFILE(OLDEMP) +
               MBR(N67)
             CALL PGM(CHECK)

                Program CHECK
Override 3      OVRDBF FILE(INPUT) +
                  TOFILE(NEWEMP) MBR(N77) +
                  SECURE(*YES)
                CALL PGM(EREPORT)

                   Program EREPORT
                   (NEWEMP and PRINT1 are
                   opened.)

Override 4      OVRDBF FILE(INPUT) +
                  TOFILE(NEWEMP) MBR(N77)
                CALL PGM(ELIST)

                   Program ELIST
                   (OLDEMP and PRINT1 are
                   opened.)
```

When program EREPORT is called, it attempts to open the files INPUT and PRINT1. EREPORT actually opens files NEWEMP, member N77. Because override 3 specifies SECURE(*YES), override 2 is not applied. When program ELIST is called, it also attempts to open the files INPUT and PRINT1. ELIST actually opens files OLDEMP, member N67. Because override 4 has the same name as override 3 and is at the same call level as override 3, it replaces override 3. Thus, the file is no longer protected from overrides at lower call levels, and override 2 is applied for program ELIST.

PRINT1 is affected only by override 1, which is in effect for both programs EREPORT and ELIST.

Using a Generic Override for Printer Files

The OVRPRTF command allows you to have one override for all the printer files in your job with the same set of values. Without the generic override, you would have to do a separate override for each of the printer files.

Following are specific examples of applying the OVRPRTF command.

Applying OVRPRTF with *PRTF: The OVRPRTF command can be applied to all printer files by specifying *PRTF as the file name.

The OVRPRTF command with *PRTF is applied if there is no other override for the printer file name at the same call level. The following example shows how *PRTF works:

```
Override 1  OVRPRTF FILE(OUTPUT) COPIES(6) +
              LPI(6)

Override 2  OVRPRTF FILE(*PRTF) COPIES(1) +
              LPI(8)
            CALL PGM(X)
```

When program X opens the file OUTPUT, the opened file has the following attributes:

COPIES(6)	From Override 1
LPI(6)	From Override 1

When program X opens the file PRTOUT (or any printer file other than OUTPUT), the opened file has the following attributes:

COPIES(1)	From Override 2
LPI(8)	From Override 2

Applying OVRPRTF with *PRTF from Multiple Call Levels: The following example shows how printer-file overrides are applied from multiple call levels using the *PRTF value.

```
            Program A
Override 1  OVRPRTF FILE(*PRTF) COPIES(1)
Override 2  OVRPRTF FILE(PRT2) COPIES(2)
Override 3  OVRPRTF FILE(PRT4) COPIES(2)
            CALL PGM(B)

               Program B
Override 4     OVRPRTF FILE(*PRTF) LPI(4)
Override 5     OVRPRTF FILE(PRT3) LPI(8)
Override 6     OVRPRTF FILE(PRT4) LPI(8)
               CALL PGM(X)
```

When program X opens the file PRT1, the opened file has the following attributes:

COPIES(1)	From Override 1
LPI(4)	From Override 4

Because no specific overrides are found for PRT1, *PRTF overrides (1 and 4) are applied.

When program X opens the file PRT2, the opened file has the following attributes:

COPIES(2)	From Override 2
LPI(4)	From Override 4

Because no specific override is found for PRT2 in program B, override 4 is applied. In program A, override 2 specifies PRT2 and is applied.

When program X opens the file PRT3, the opened file has the following attributes:

COPIES(1)	From Override 1
LPI(8)	From Override 5

In program B, override 5 specifies PRT3 and is applied. Because no specific override is found for PRT3 in program A, override 1 is applied.

When program X opens the file PRT4, the opened file has the following attributes:

COPIES(2)	From Override 3
LPI(8)	From Override 6

In program B, override 6 specifies PRT4 and is applied. In program A, override 3 specifies PRT4 and is applied.

Applying Overrides When Compiling a Program

Overrides may be applied at the time a program is being compiled for either of two purposes:

- To select the source file
- To provide external data definitions for the compiler to use in defining the record formats to be used on I/O operations

Overrides to the source file are handled just like any other override. They may select another file, another member of a database file, another label for diskette or tape, or change other file attributes.

Overrides may also be applied to files that are used within the program being compiled, if they are being used as externally described files in the program. These files are not opened at compile time, and thus the overrides are not applied in the normal manner. These overrides are used at compile time only to determine the file name and library that will be used to define the record formats and fields for the program to use I/O operations. Any other file attributes specified on the override are ignored at compile time. It is necessary that these file overrides be active at compile time only if the file name specified in the source for the program is not the file name that contains the record formats that the application needs.

The file name that is opened when the compiled program is run is determined by the file name that the program source refers to, changed by whatever overrides are in effect at the time the program runs. The file name used at compile time is not kept. The record formats in the file that is actually opened must be compatible with those used when the program was compiled. Obviously, the easiest way to assure record compatibility is to have the same overrides active at run time that were active at compile time. If your program uses externally described data and a different field level file is used at run time, it is usually necessary to specify LVLCHK(*NO) on the override. See "File Redirection" on page 3-17 for details.

The following example shows how overrides work when compiling a program:

```
Override 1   OVRDBF FILE(RPGSRC) +
               TOFILE(SRCPGMS) MBR(INVN42)
Override 2   OVRPRTF FILE(OUTPUT) TOFILE(REPORTS)
             CALL PGM(A)

               Program A
Override 3     OVRPRTF FILE(LISTOUT) +
                 TOFILE(OUTPUT)
Override 4     OVRDBF FILE(RPGSRC) WAITFILE(30)
               CRTRPGPGM PGM(INVENTORY) +
                 SRCFILE(RPGSRC)
               RETURN

Override 5   OVRPRTF FILE(LISTOUT) +
               TOFILE(REPORTS) LPI(8)
             CALL PGM(INVENTORY)
```

The program INVENTORY opens the printer file REPORTS in place of printer file LISTOUT and creates output at 8 lines per inch.

The program INVENTORY is created (compiled) from the member INVN42 in the database file SRCPGMS. Override 4 (applied first) overrides an optional file attribute. Override 1 (applied last) causes the file RPGSRC to be overridden with the database file SRCPGMS, member INVN42.

The program INVENTORY is created with the printer formats from the file REPORTS. Assume that the source for the program INVENTORY, taken from file SRCPGMS and member INVN42, contains an open to the printer file LISTOUT. Override 3 (applied first) causes the file LISTOUT to be overridden with OUTPUT. Override 2 (applied last) overrides OUTPUT with REPORTS. Other attributes may be specified here, but it is not necessary because only the record formats are used at compile time.

At run time, override 3 is no longer active, because program A has ended. Therefore override 2 has no effect on LISTOUT. However, override 5, which is active at run time, replaces LISTOUT with REPORTS and specifies 8 lines per inch. Because the same file is used for both compilation and run-time, level checking may be left on.

Effect of Overrides on Some System Commands

The following commonly used commands ignore overrides entirely:

ADDLFM	DSPDBR
ADDPFM	DSPFD
ALCOBJ	DSPFFD
APYJRNCHG	DSPJRN
CHGOBJOWN	EDTOBJAUT
CHGPTR	EDTDLOAUT
CHGSBSD	ENDJRNPF
CHGXXXF (all change file commands)	GRTOBJAUT
CLRPFM	INZPFM
CLRSAVF	MOVOBJ
CPYIGCTBL	RGZPFM
CRTDKTF	RMVJRNCHG
CRTDUPOBJ	RMVM
CRTAUTHLR	RNMOBJ
CRTSBSD	RVKOBJAUT
CRTTAPF	SBMDBJOB
DLCOBJ	SIGNOFF
DLTF	STRDBRDR
DLTAUTHLR	STRJRNPF

Note: Save and restore operations ignore all file overrides related to the save and restore media (tape, diskette, save file).

Overrides are not applied to any system files that are opened as part of an end-of-routing step or end-of-job processing. For example, overrides cannot be specified for the job log file. In some cases, when you need to override something in a system file, you may be able to change it through a command other than an override command. For example, to change the output queue for a job log, the output queue could be changed before sign-off using the OUTQ parameter on the Change Job (CHGJOB) command to specify the name of the output queue for the job. If the printer file for the job log contains the value *JOB for the output queue, the output queue is the one specified for the job.

The following commands allow overrides for the SRCFILE and SRCMBR parameters only:

CRTCMD	CRTPRTF
CRTICFF	CRTSRCPF
CRTDSPF	CRTTBL
CRTLF	CRTPF

CRTXXXPGM
(All create program commands. These commands also use overrides to determine which file will be opened by a compiled program. See "Applying Overrides When Compiling a Program" on page 3-11 for more information.)

The following command allows overrides for the TOFILE, MBR, SEQONLY, LVLCHK, and INHWRT parameters:

OPNQRYF

The following commands allow overrides, but do not allow changing the MBR to *ALL:

CPYFRMPCD CPYTOPCD

The following commands do not allow overrides to be applied to the display files they use. Overrides to the printer files they use should not change the file type or the file name. Various restrictions are placed on changes that may be made to printer files used by these commands, but the system can not guarantee that all combinations of possible specifications will produce an acceptable report.

DMPOBJ and DMPSYSOBJ
(In addition to the preceding limitations, these commands do not allow overrides to the file they dump.)
DSPXXXXXX
(All display commands. The display commands that display information about a file do not allow overrides to that file.)
DSPIGCDCT
EDTIGCDCT
GO
(Message file can be overridden.)
PRTXXXXXX
(All print commands.)
QRYDTA
TRCXXX
(All trace commands.)
WRKXXXXXX
(All work-with commands.)

Deleting Overrides

| When a program that has been called returns control to the calling program, any overrides specified in the call level of the called program are deleted. This does not include overrides that are scoped to the job level. Overrides that are scoped to the job level remain in effect until they are

explicitly deleted, replaced, or until the job in which they are specified ends.

When control is transferred to another program (TFRCTL command), the overrides in the call level of the transferring program are not deleted. If you want to delete an override before the program has completed running, you can use the Delete Override (DLTOVR) command. This command can delete overrides in the call level in which the command is entered (the default) or delete overrides that are scoped to the job level. To delete overrides that are scoped to the job level, you must specify OVRSCOPE(*JOB) on the DLTOVR command.

To identify an override, use the file name specified on the FILE parameter of the override command. You can delete all overrides at the current call level or at the job level by specifying value *ALL for the FILE parameter. In the following example, assume that all the commands are entered at the same call level:

```
Override 1          OVRDBF FILE(DBA) +
                      TOFILE(DBB)
Override 2          OVRPRTF FILE(PRTC) +
                      COPIES(2)
Override 3          OVRDKTF FILE(DKT) +
                      EXCHTYPE(*BASIC)
Delete Override 1  DLTOVR FILE(DBA)
Delete Override 2  DLTOVR FILE(*ALL)
```

Delete override 1 causes override 1 to be deleted. Delete override 2 causes the remaining overrides (overrides 2 and 3) to be deleted.

In the following example, assume that commands 1, 2, and 13 are entered interactively, at call level 1:

```
Command 1     OVRDBF FILE(DBA) TOFILE(DBB) +
                SECURE(*YES)

Command 2     CALL PGM(A)

                Program A
Command 3       OVRPRTF FILE(DBB) TOFILE(PRTC) +
                  LPI(6)
Command 4       OVRDBF FILE(DBC) TOFILE(DBD) +
                  OVRSCOPE(*JOB)
Command 5       TFRCTL PGM(B)

                Program B
Command 6       OVRDKTF FILE(DKTE) TOFILE(DKTF)
Command 7       CALL PGM(QCMDEXC)  +
                  PARM('OVRDSPF FILE(DSPG) +
                  TOFILE(DSPH)' 31)
Command 8       DLTOVR FILE(DBA DBB)
Command 9       MONMSG MSGID(CPF9841)
Command 10       CALL PGM(QCMDEXC) +
                  PARM('DLTOVR FILE(*ALL)' 17)

Command 11      DLTOVR FILE(DBC) OVRSCOPE(*JOB)
Command 12      RETURN
Command 13    DLTOVR FILE(*ALL)
```

Command 1 causes an override at level 1 from file DBA to file DBB.

Command 2 calls program A and creates a new call level (call level 2).

Command 3 causes an override at level 2 from file DBB to file PRTC. Also, the LPI attribute of file PRTC is overridden to 6.

Command 4 causes an override at the job level from file DBC to file DBD.

Command 5 transfers control from program A to program B at the same call level (call level 2).

Command 6 causes an override at level 2 from file DKTE to file DKTF.

Command 7 causes an override at level 2 from file DSPG to file DSPH. A call to QCMDEXC does not cause a new call level.

Command 8 deletes any overrides of files DBA and DBB at level 2. The override specified by command 3 is deleted, but the override specified by command 1 is not deleted. Because an override for DBA cannot be found at level 2, the override-not-found escape message (CPF9841) is sent.

Command 9 monitors for a message to prevent a function check, but it specifies no action to be taken if the message is sent.

Command 10 deletes all remaining overrides at level 2. Overrides specified by commands 6 and 7 are deleted, but the overrides specified by commands 1 and 4 are not deleted.

Command 11 deletes overrides to file DBC that are scoped to the job level. The override specified by command 4 is deleted.

Command 12 causes a return to level 1, and level 2 is deleted. If any overrides were specified at level 2 (scoped to the call level) between command 10 and command 12, they are deleted at this point.

Command 13 causes all overrides specified at call level 1 to be deleted. The override specified by command 1 is deleted.

Note: Command 13 would not delete any overrides that were scoped to the job level (although there are none in this example at the time command 13 is issued). In general, to delete all overrides at the job level, you would have to specify DLTOVR FILE(*ALL) OVRSCOPE(*JOB).

Displaying Overrides

You can use the Display Override (DSPOVR) command to display file overrides at the job level and at multiple call levels for a job. You can display all file overrides, or file overrides for a specific file.

The file overrides may be merged before being displayed. A merged override is the result of combining overrides from the job level to the current level or any specified call level, producing a composite override which will be applied when the file is used at the specific call level. The current call level is the call level of the program that is currently running. This program is the last program name displayed on the call stack. This command may be requested from either a batch or interactive environment. You can also access this function from option 15 (Display file overrides) from the Work with Job menu (using the WRKJOB command) or by selecting option 15 (Display file overrides) from the Display Job menu (using the DSPJOB command).

1. To display the merged file override for a particular file at a specific call level, you type:

   ```
   DSPOVR FILE(REPORTS) MRGOVR(*YES) LVL(3)
   ```

   This command produces a display showing the merged override for the file REPORTS at call level 3 with text descriptions of each keyword and parameter. Any applicable overrides at the job level and at call levels 1, 2, and 3 are used to form the merged override, but overrides at higher call levels are ignored. If the call level specified is not active, all applicable overrides up to the current level are used.

2. To display all file overrides for a specific file up to a specific call level, you type:

   ```
   DSPOVR FILE(REPORTS) MRGOVR(*NO) LVL(2)
   ```

   This command produces a display showing the file name, the call level for which the override was requested, the type of override, and the override parameters in keyword-parameter form. If no file overrides are found for the file up to and including the specified call level, escape message CPF9842 is sent. If you are using DSPOVR in a CL program, you might want to add a MONMSG command following the DSPOVR command to prevent your program from ending if there are no overrides for the file. This technique is illustrated in some of the examples later in this chapter. For more information on the MONMSG command, refer to the *CL Programmer's Guide*.

3. To display the merged file overrides for all files at the current call level, you type:

   ```
   DSPOVR FILE(*ALL) MRGOVR(*YES) LVL(*)
   ```

   This command produces a display showing the file name, the type of override, and the merged overrides in keyword-parameter form, where only the keywords and parameters entered on the commands are displayed. This is the same as what happens when you type DSPOVR with no parameters. Only those keywords for which parameters were specified are displayed. The associated text descriptions are not displayed. Overrides at call levels greater than 999 are not displayed.

4. When overrides are displayed not by the DSPOVR command, but through an option on one of the system interfaces to work with jobs (for example, WRKJOB), all file overrides from the job level to the current call level are displayed. This would be the same as typing the following command:

   ```
   DSPOVR FILE(*ALL) MRGOVR(*NO) LVL(*)
   ```

   This produces a display showing the file name, the level (call level or job level) for which the override was requested, the type of override, and the override parameters in keyword-parameter form for each override.

   Because the display overrides function uses a copy of the internal control blocks, overrides that were deleted between the time the display overrides function was called and the time the output was produced may not be reflected in the output. This can occur only when the overrides in another job are being displayed.

Note that when specifying a call level, as in the first two examples in this section, the call level on which you first entered override commands may not be level 1. Depending on the contents of the first program and first menu specified in your user profile, and any other programs or menus you may have come through, you may have entered your first override commands at level 3 or 4. You may enter WRKJOB and select option 11 (call stack) to see what programs are running at lower call levels.

Unless you know exactly what you want to see, it is usually best to request the override display with no parameters, because options on the basic override display allow you to select a detailed display of any override you are interested in. The specific options available are:

- From the merged display of all overrides, you can request the display that is not merged, as in step 4.
- From the display (not merged) of all overrides, you can request the merged display.
- From the merged display of all overrides, you can request a merged detail display of any override, equivalent to step 1 on page 3-14.
- From the merged display of all overrides, you can request a display of all the individual overrides that contributed to the merged display, showing the level (call level or job level) for which each was requested.
- From either the display of contributing overrides or the display (not merged) of all overrides, you can request a detail display of the override for a particular file at a single call level.

The following example is intended only to illustrate what the various forms of the display override command can do. The DSPOVR command is typically entered interactively or added temporarily to a CL program, or to any high-level language program via QCMDEXC, to verify that the proper overrides are in effect at the time a program is called or a file is opened. Assume that commands 1, 2, 3, and 18 are entered at call level 1:

```
Command 1    OVRPRTF FILE(PRTA) COPIES(3)
Command 2    OVRDBF FILE(DBC) WAITFILE(*IMMED)
Command 3    CALL PGM(A)

                Program A
Command 4       OVRPRTF FILE(PRTB) +
                  TOFILE(PRTA) COPIES(6)
Command 5       OVRDBF FILE(DBC) WAITFILE(60)
Command 6       OVRDBF FILE(DBE) TOFILE(DBF) +
                 OVRSCOPE(*JOB)
Command 7       DSPOVR FILE(PRTB) MRGOVR(*YES)
Command 8       CALL PGM(B)

                   Program B
Command 9          CALL PGM(QCMDEXC) +
                     PARM('OVRDSPF FILE(DSPE) +
                     TOFILE(DSPF)' 31)
Command 10         OVRDBF FILE(DBC) TOFILE(DBD)
Command 11         DSPOVR FILE(DBC) MRGOVR(*NO) +
                     LVL(3)
Command 12         DSPOVR FILE(DBD) MRGOVR(*NO) +
                     LVL(2)
Command 13         MONMSG MSGID(CPF9842)
Command 14         CALL PGM(QCMDEXC) +
                     PARM('DSPOVR FILE(*ALL) +
                     MRGOVR(*YES) LVL(*) +
                     OUTPUT(*)' 47)
Command 15         RETURN

Command 16      DSPOVR FILE(*ALL) MRGOVR(*NO)
Command 17      RETURN

Command 18   DSPOVR FILE(*ALL) MRGOVR(*NO) +
                LVL(2) OUTPUT(*)
```

Command 1 causes an override at level 1 of the COPIES attribute of file PRTA to 3 copies.

Command 2 causes an override at level 1 of the WAITFILE attribute of file DBC to *IMMED.

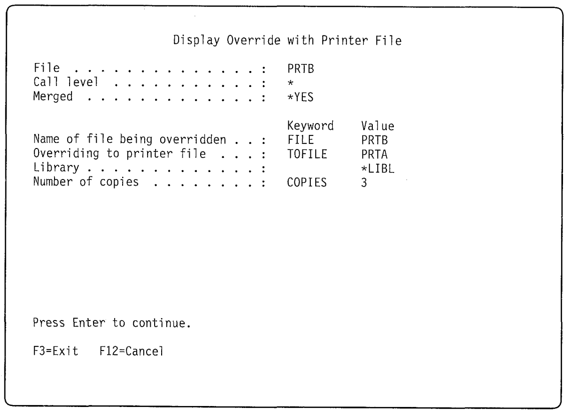
Command 3 calls program A and creates a new call level, 2.

Command 4 causes an override at level 2 from file PRTB to file PRTA. Also, the COPIES attribute is overridden to 6.

Command 5 causes an override at level 2 of the WAITFILE attribute of file DBC to 60.

Command 6 causes an override of file DBE to file DBF and scopes the override to the job level.

Command 7 displays a merged override for file PRTB at level 2 with text descriptions of each keyword and parameter, as shown in Figure 3-5. The to-file is PRTA because of command 4, and the COPIES attribute is 3 because of command 1.



```
                      Display Override with Printer File

File . . . . . . . . . . . . . . :   PRTB
Call level . . . . . . . . . . . :   *
Merged . . . . . . . . . . . . . :   *YES

                                     Keyword    Value
Name of file being overridden . . :  FILE       PRTB
Overriding to printer file  . . . :  TOFILE     PRTA
Library . . . . . . . . . . . . . :             *LIBL
Number of copies  . . . . . . . . :  COPIES     3




Press Enter to continue.

F3=Exit   F12=Cancel
```

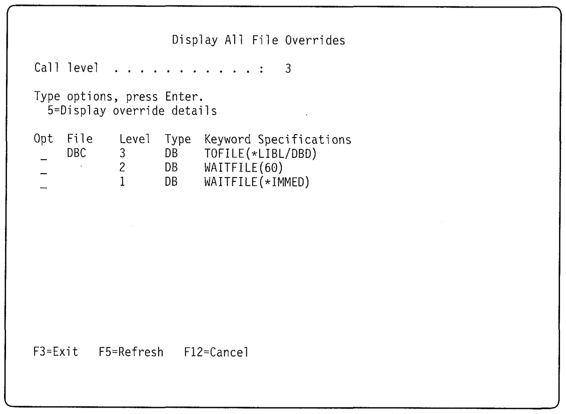
Figure 3-5. Override with Printer File Display

Command 8 calls program B and creates the new call level 3.

Command 9 causes an override at level 3 from file DSPE to file DSPF. An override done via a call to the QCMDEXC program takes the call level of the program that called the QCMDEXC program.

Command 10 causes an override of file DBC to file DBD.

Command 11 displays all overrides for file DBC from level 1 to level 3, as shown in Figure 3-6. The overrides specified by commands 9, 5, and 2 are displayed in keyword-parameter form. Observe that this form of the DSPOVR command shows all the overrides for the selected file, regardless of redirection. The three overrides that are shown would not be merged because of the name change at level 3.



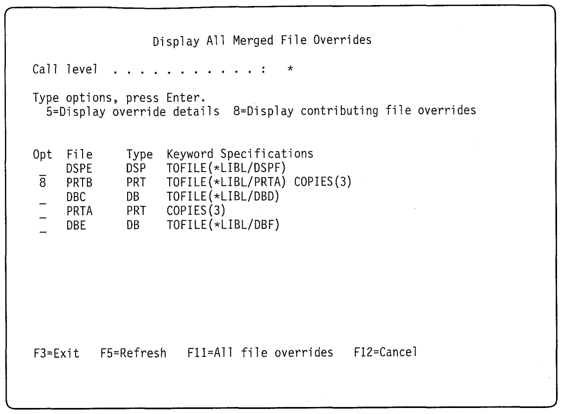
```
                      Display All File Overrides

Call level  . . . . . . . . . . . :   3

Type options, press Enter.
  5=Display override details

Opt  File     Level  Type  Keyword Specifications
 _   DBC      3      DB    TOFILE(*LIBL/DBD)
 _            2      DB    WAITFILE(60)
 _            1      DB    WAITFILE(*IMMED)




F3=Exit   F5=Refresh   F12=Cancel
```

Figure 3-6. All File Overrides Display (One File)

Command 12 attempts to display all file overrides for file DBD from level 1 to level 2. Because no overrides for file DBD exist at levels 1 or 2, no overrides are displayed, and the override-not-found escape message (CPF9842) is sent.

Command 13 monitors for message CPF9842 on the preceding command. The monitor specifies no action to be taken, but will prevent a function check if the message is sent.

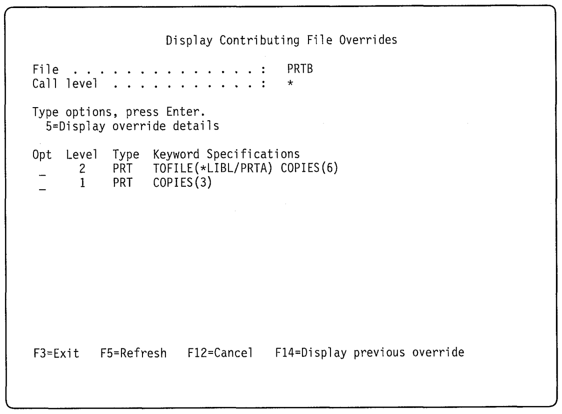
Command 14 displays the merged overrides at the job level to call level 3 for all files in keyword-parameter form, as shown in Figure 3-7 on page 3-17. File DBC is overridden to file DBD because of command 10 (commands 5 and 2 are therefore not effective). File DSPE is overridden to file DSPF because of command 9. File PRTB is overridden to file PRTA and COPIES(3) because of commands 4 and 1. File DBE is overridden to file DBF because of command 6.



```
                    Display All Merged File Overrides

Call level  . . . . . . . . . . . :   *

Type options, press Enter.
  5=Display override details  8=Display contributing file overrides


Opt  File      Type  Keyword Specifications
 _   DSPE      DSP   TOFILE(*LIBL/DSPF)
 8   PRTB      PRT   TOFILE(*LIBL/PRTA) COPIES(3)
 _   DBC       DB    TOFILE(*LIBL/DBD)
 _   PRTA      PRT   COPIES(3)
 _   DBE       DB    TOFILE(*LIBL/DBF)







F3=Exit   F5=Refresh   F11=All file overrides   F12=Cancel
```

Figure 3-7. All Merged File Overrides Display

If you enter a 5 on the line for PRTB, you get a detail display like the one shown in Figure 3-5 on page 3-16. If you enter an 8 on this same line, you get a display showing commands 4 and 1 on separate lines, as shown in Figure 3-8. These are the overrides that were merged to form the PRTB override.

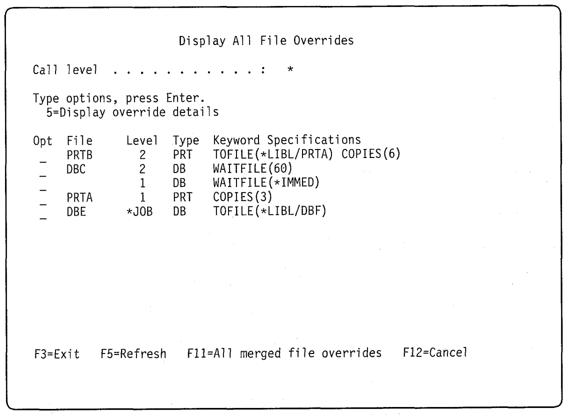


```
                    Display Contributing File Overrides

File  . . . . . . . . . . . . . . :   PRTB
Call level  . . . . . . . . . . . :   *

Type options, press Enter.
  5=Display override details

Opt  Level  Type  Keyword Specifications
 _     2    PRT   TOFILE(*LIBL/PRTA) COPIES(6)
 _     1    PRT   COPIES(3)








F3=Exit   F5=Refresh   F12=Cancel   F14=Display previous override
```

Figure 3-8. Contributing File Overrides Display

Command 15 causes a return to level 2, and level 3 is deleted. The overrides issued at level 3 are implicitly deleted.

Command 16 displays all overrides issued for the job level to the current call level (level 2), as shown in Figure 3-9. The overrides specified in commands 1, 2, 4, 5, and 6 are displayed in keyword-parameter form. The override issued in command 10 is not displayed because call level 3 is no longer active. Pressing F11 on this display allows you to see a display similar to the one shown in Figure 3-7.



```
                       Display All File Overrides

Call level  . . . . . . . . . . . :   *

Type options, press Enter.
  5=Display override details

Opt  File      Level  Type  Keyword Specifications
 _   PRTB        2    PRT   TOFILE(*LIBL/PRTA) COPIES(6)
 _   DBC         2    DB    WAITFILE(60)
 _               1    DB    WAITFILE(*IMMED)
 _   PRTA        1    PRT   COPIES(3)
 _   DBE       *JOB   DB    TOFILE(*LIBL/DBF)







F3=Exit   F5=Refresh   F11=All merged file overrides   F12=Cancel
```

Figure 3-9. All File Overrides Display (All Files)

Command 17 causes a return to level 1, and level 2 is deleted. The overrides issued at level 2 that are scoped to the call level are implicitly deleted. However, the override caused by command 6 is not deleted.

Command 18 displays all overrides for the job level to call level 2 in keyword-parameter form. Because level 2 is no longer active, only the overrides scoped to the job level (command 6) and those specified at level 1 in commands 1 and 2 are displayed.

File Redirection

File redirection refers to using overrides to change the file name and library or the type of the file to be processed. For example, you can substitute one database file for another or change from using an ICF file to using a display file. This section applies to using an application program only. System code may or may not support file redirection. Refer to "Effect of Overrides on Some System Commands" on page 3-12 for rules on how system code processes overrides.

You use the OVRDBF command to redirect a file to a Distributed Data Management (DDM) file. If the remote system is another AS/400 system, all normal rules discussed in this chapter apply. If the remote system is not an AS/400 system or System/38, then normally you should not specify an expiration date or end-of-file delay. For more information, refer to the *Distributed Data Management Guide.*

When you replace the file that is used in a program with another file of the same type, the new file is processed in the same manner as the original file. If a field level file, or any other file containing externally described data is redirected, it usually is necessary to either specify LVLCHK(*NO) or recompile the program. With level checking turned off, it is still necessary that the record formats in the file be compatible with the records in the program. If the formats are not compatible, the results cannot be predicted.

Overrides that have a TOFILE parameter value other than *FILE remove any database member specifications that may be on overrides applied at higher call levels. The member name will default to *FIRST unless it is specified with the change to the file name or library or on another override at a lower call level.

If you change to a different type of file, the device-dependent characteristics are ignored and records are read or written sequentially. Some device parameters must be specified in the new device file or the override. Defaults are taken for others. The effect of specific redirection combinations is described later in this section.

Any attributes specified on overrides of a different file type than the final file type are ignored. The parameters SPOOL, SHARE, and SECURE are exceptions to this rule. They will be accepted from any override applied to the file, regardless of device type.

Some redirection combinations present special problems due to the specific characteristics of the device. In particular:

- File redirection is not recommended for save files.
- Nonsequentially processed database files can be redirected only to another database file or a DDM file.
- Display files and ICF files that use multiple devices (MAXDEV or MAXPGMDEV > 1) can be redirected only to a display file or ICF file.
- Redirecting a display file to any other file type, or another file type to a display file, requires that the program be recompiled with the override active if there are any input-only or output-only fields. This is necessary because the display file omits these fields from the record buffer in which they are not used, but other file types do not.

Table 3-1 summarizes valid file redirections.

To use this chart, identify the file type to be overridden in the FROM-FILE columns and the file type overriding in the TO-FILE column. The intersection specifies an I or O or both, meaning that the substitution is valid for these two file types when used as input files or as output files.

For instance, you can override a diskette output file with a tape output file, and a diskette input file with a tape input file. The chart refers to file type substitutions only. That is, you cannot change the program function by overriding an input file with an output file. The charts on the following pages describe the specific defaults taken and what is ignored for each redirection combination.

Table 3-1. File Redirections

	From-File					
To-File	**Printer**	**ICF**	**Dis-kette**	**Display**	**Data-base**	**Tape**
Printer	O*	O	O	O	O	O
ICF	O	I/O O I	O I	I/O O I	O I	O I
Diskette	O	O I	O I	O I	O I	O I
Display	O	I/O O I	O I	I/O O I	O I	O I
Database	O	O I	O I	O I	O I	O I
Tape	O	O I	O I	O I	O I	O I

I=input file O=output file I/O=input/output file
*=redirection to a different type of printer

From	Printer
To	ICF: Records are written to the file one at a time. Printer control information is ignored. Display: Records are written to the display with each record overlaying the previous record. For program-described files, you can request each record using the Enter key. Printer control information is ignored. Database: Records are written to the database in sequential order. Printer control information is ignored. Diskette: The amount of data written on diskette is dependent on the exchange type of the diskette. Diskette label information must be provided in the diskette file or on an override command. Printer control information is ignored. Refer to the *Guide to Programming for Tape and Diskette* for a description of exchange types. Tape: Records are written to the tape in sequential order. Tape label information must be specified in the tape file or on an override command. Printer control information is ignored.

From	ICF input
To	Display: Records are retrieved from the display one at a time. Type in the data for each record and press the Enter key when the record is complete. Database: Records are retrieved from the database. Diskette: Records are retrieved in sequential order. Diskette label information must be provided in the diskette file or on an override command. Refer to the *Guide to Programming for Tape and Diskette* for a description of exchange types. Tape: Records are retrieved in sequential order. Tape label information must be specified in the tape file or on the override command.

From	ICF output
To	Printer: Records are printed and folding or truncating is performed as specified in the printer file. Display: Records are written to the display with each record overlaying the previous record. Database: Records are written to the database in sequential order. Diskette: The amount of data written on diskette is dependent on the exchange type of the diskette. Diskette label information must be provided in the diskette file or on an override command. Refer to the *Guide to Programming for Tape and Diskette* for a description of exchange types. Tape: Records are written to the tape in sequential order. Tape label information must be specified in the tape file or on the override command.

From ICF input/output

To Display: Input records are retrieved from the display one at a time. Type in the data for each record and press the Enter key when the record is complete. Output records are written to the display with each record overlaying the previous input or output record. Input and output records are essentially independent of each other and may be combined in any manner.

From Diskette input

To ICF: Records are retrieved from the ICF file one at a time.

Display: Records are retrieved from the display one at a time. Type in the data for each record and press the Enter key when the record is complete. A nonfield-level device file must be specified. Diskette label information is ignored.

Database: Records are retrieved in sequential order. Diskette label information is ignored.

Tape: Records are retrieved in sequential order. If a label value is specified in the program, that value is used as the label for the tape file.

From Diskette output

To ICF: Records are written to the ICF file one at a time.

Database: Records are written to the database in sequential order.

Display: Records are written to the display with each record overlaying the previous record. You can request each output record using the Enter key.

Printer: Records are printed and folding or truncating is performed as specified in the printer file.

Tape: Records are written on tape in sequential order.

From Display input

To ICF: Records are retrieved from the ICF file one at a time.

Diskette: Records are retrieved in sequential order. Diskette label information must be provided in the diskette file or on an override command. Refer to the *Guide to Programming for Tape and Diskette* for a description of exchange types.

Database: Input records are retrieved.

Tape: Records are retrieved in sequential order. Tape label information must be specified in the tape file or on an override command.

From Display output

To ICF: Records are written to the ICF file one at a time.

Database: Records are written to the database in sequential order.

Diskette: The amount of data written on diskette is dependent on the exchange type of the diskette. Diskette label information must be provided in the diskette file or on an override command. Refer to the *Guide to Programming for Tape and Diskette* for a description of exchange types.

Tape: Records are written on tape in sequential order. Tape label information must be specified in the tape file or on an override command.

Printer: Records are printed and folding or truncating is performed as specified in the printer file.

From Display input/output

To ICF: Input records are retrieved from the ICF file one at a time. Output records are written to the ICF file one at a time. The relationship between the input and output records is determined by the application program.

From Database input (sequentially processed)

To ICF: Records are retrieved from the ICF file one at a time.

Display: Records are retrieved from the display one at a time. Type in the data for each record and press the Enter key when the record is complete. A nonfield-level device file must be specified.

Diskette: Records are retrieved in sequential order. Diskette label information must be provided in the diskette file or on an override command. Refer to the *Guide to Programming for Tape and Diskette* for a description of exchange types.

Tape: Records are retrieved from tape in sequential order. Tape label information must be specified in the tape file or on an override command.

From	Database output (sequentially processed)
To	Printer: The number of characters printed is determined by the page size specified. If folding is specified, all of a record is printed. ICF: Records are written to the ICF file one at a time. Display: Records are written to the display with each record overlaying the previous record. You can request each output record using the Enter key. Diskette: The amount of data written on diskette depends on the exchange type of the diskette. Diskette label information must be provided in the diskette file or on an override command. Refer to the *Guide to Programming for Tape and Diskette* for a description of exchange types. Tape: Records are written on tape in sequential order. Tape label information must be specified in the tape file or on an override command.

From	Tape input
To	ICF: Records are retrieved from the ICF file one at a time. Display: Records are retrieved from the display one at a time. Type in the data for each record and press the Enter key when the record is complete. A nonfield-level device file must be specified. Tape label information is ignored. Database: Records are retrieved in sequential order. One record is read as a single field. Tape label information is ignored. Diskette: Records are retrieved in sequential order. If a label value is specified in the program, that value is used as the label for the diskette file.

From	Tape output
To	Printer: Records are printed, and folding or truncating is performed as specified in the printer file. ICF: Records are written to the ICF file one at a time. Tape label information is ignored. Diskette: The amount of data written on diskette depends on the exchange type of the diskette. If a label value is specified in the program, that value is used as the label for the diskette file. Refer to the *Guide to Programming for Tape and Diskette* for a description of exchange types. Display: Records are written to the display with each record overlaying the previous record. You can request each output record using the Enter key. Database: Records are written to the database in sequential order.

Overriding Program Device Entries

In addition to the file attributes and record formats similar to those in other device files, an ICF file also contains program device entries which provide the link between the application and each of the remote systems or devices with which your program communicates.

The following lists the CL commands that provide override functions for device entries:

DLTOVRDEVE
: Delete Override Device Entry: Deletes one or more program device overrides that were previously specified in a call level.

OVRICFDEVE
: Override with Intersystem Communications Program Function Device Entry: Used to temporarily add the program device entry and the remote location name to the ICF file or to override a program device entry with the specified

remote location name and attributes for an ICF file.

A program device entry has two functions:

- It associates a program device name with a remote location.
- It establishes a set of program communications-type dependent attributes.

Multiple program device entries can be defined. Each program device entry must have a unique program device name. The maximum number of entries is determined by the MAXPGMDEV parameter specified at file creation.

Program device entries may be defined by the Add Intersystem Communications Function Program Device Entry (ADDICFDEVE) command or the OVRICFDEVE command. The add command makes a permanent addition to the file, and the override command makes a temporary change to the program device information. It is not necessary to add a program device entry before overriding it. Several add commands may be used to add multiple program devices to the same file. Several override commands may be used to change different device entries. Refer to the *ICF Programmer's Guide* for more information on program device entries and for a list of the parameters supported by each communications type.

Overriding Remote Location Name

The device entry override may be used to temporarily define or change the remote location name associated with the program device entry.

The following example demonstrates the use of the OVRICFDEVE command to override the remote location name:

```
OVRICFDEVE PGMDEV(PGMDEVA) RMTLOCNAME(CHICAGO)
CALL RPGPGM
```

In this example, when RPGPGM specifies PGMDEVA, remote location CHICAGO is used. Refer to the *ICF Programmer's Guide* for more information on remote location name and its relationship to configuration.

Overriding Session Attributes

The device entry override may also be used to temporarily change the characteristics of the communications session that is established when the program device is acquired.

Although some of the session attributes have system-level defaults, the default for the majority of these attributes is information supplied during communications configurations.

Session attributes are identified as parameters on the ADDICFDEVE or OVRICFDEVE command. Parameters not specified on either command take on the appropriate system default or specified configuration value. If the same parameter is specified on both the ADDICFDEVE and OVRICFDEVE commands, the value specified on OVRICFDEVE overrides the value declared on the ADDICFDEVE command.

The following example demonstrates the use of the OVRICFDEVE command to override the format selection processing attribute:

```
OVRICFDEVE PGMDEV(PGMDEVA) FMTSLT(*PGM)
```

In this example, format selection is changed to *PGM. This overrides what was previously defined in the program device entry. Refer to the appropriate communications programming manual for more information on the use of the session attributes. Refer to the *CL Reference* manual for more information on the format and allowable values of the parameters on the OVRICFDEVE command.

Overriding Remote Location Name and Session Attributes

This form of the override device entry is a combination of the previous two forms. With this form of override, you can override the remote location that is used by a program, and you can also override the session attributes.

Applying OVRICFDEVE Command

Device entry overrides follow most of the same rules as file overrides. They are effective from the time they are specified until they are replaced or deleted or until the program in which they were specified ends. Any program device entry overrides that are in effect at the time the device is acquired are applied.

The OVRICFDEVE command can be used to initialize an environment or change the environment while running.

In the following example, the OVRICFDEVE commands are initializing an environment:

```
Override 1   OVRICFDEVE PGMDEV(PGMDEV1) +
               RMTLOCNAME(BOSTON) . . .
Override 2   OVRICFDEVE PGMDEV(PGMDEV2) +
               RMTLOCNAME(ROCHMN) . . .
             CALL PGM(A)
             CALL PGM(B)
             .
             .
             .
             CALL PGM(X)
```

When the program uses any ICF file and acquires the program device named PGMDEV1, then the remote location named BOSTON and attributes from override 1 are used when establishing the communication session.

When the program uses an ICF file and acquires the program device named PGMDEV2, then the remote location named ROCHMN and attributes from override 2 are used when establishing the communication session.

In the following example, the OVRICFDEVE commands are used to change the running environment:

```
Override 1   OVRICFDEVE PGMDEVE(PGMDEV1) +
               RMTLOCNAME(BOSTON) . . .
             CALL PGM(A)
Override 2   OVRICFDEVE PGMDEVE(PGMDEV2) +
               RMTLOCNAME(ROCHMN) . . .
             CALL PGM(A)
```

The first time program A is called, an ICF file is opened and the program device named PGMDEV1 acquired. The remote location named BOSTON and attributes from override 1 are used when establishing the communication session.

The second time program A is called, an ICF file is opened and the program device named PGMDEV2 is acquired. The remote location named ROCHMN and attributes from override 2 are used when establishing the communication session.

Applying OVRICFDEVE from Multiple Call Levels: When you have more than one override for the same program device at several call levels (nested calls), the order in which the overrides are applied to the program device is from the highest call level to the lowest call level. Any job level overrides are applied last.

To prevent overrides at lower call levels from being applied, see"Applying OVRICFDEVE with SECURE" on page 3-25 .

In the following example, override 2 is in the highest call level and override 1 is in the lowest call level.

```
Override 1   OVRICFDEVE PGMDEV(PGMDEV1) +
               FMTSLT(*PGM) BATCH(*NO)
             CALL PGM(A)

                 Program A
Override 2       OVRICFDEVE PGMDEV(PGMDEV1) +
                   FMTSLT(*RECID) APPID(PAYROLL)
                 CALL PGM(X)
```

When program X acquires program device PGMDEV1, the following attributes are used:

FMTSLT(*PGM)	From Override 1
BATCH(*NO)	From Override 1
APPID(PAYROLL)	From Override 2

The attribute of FMTSLT(RECID) specified in override 2 is not used because it was overridden by FMTSLT(*PGM) specified in override 1. Override 1 overrides override 2. If there is a third override for program device PGMDEV1 embedded in program X, it is overridden by override 2 and then override 1.

A similar situation exists when you change the remote location to be used with the program device and you also change some of the attributes of the program device. For example:

```
Override 1   OVRICFDEVE PGMDEV(PGMDEV1) +
               RMTLOCNAME(NYCAPPC)
             CALL PGM(A)

               Program A
Override 2     OVRICFDEVE PGMDEV(PGMDEV1) +
                 RMTLOCNAME(MPLSAPPC) +
                 CNVTYPE(*USER)
               CALL PGM(X)
```

When program X is ready to acquire PGMDEV1, it acquires remote location NYCAPPC instead of MPLSAPPC (because override 1 overrides override 2 remote location). Also, the conversation type is *USER (because of override 2).

Applying OVRICFDEVE with SECURE:

On occasion, you may want to protect program devices used by a program from overrides at lower call levels.

You can prevent additional program device overrides by coding the SECURE(*YES) parameter on a program device override command for each program device needing protection. This protects you from overrides at lower call levels.

The following shows an example of a protected program device:

```
Override 1   OVRICFDEVE PGMDEV(PGMDEV1) +
               RMTLOCNAME(BOSTON)
Override 2   OVRICFDEVE PGMDEV(PGMDEV4) +
               RMTLOCNAME(ROCHMN)
             CALL PGM(A)

               Program A
Override 3     OVRICFDEVE PGMDEV(PGMDEV5) +
                 RMTLOCNAME(NYC)
               CALL PGM(B)

                 Program B
Override 4       OVRICFDEVE PGMDEV(PGMDEV1) +
                   RMTLOCNAME(MPLS) SECURE(*YES)
                 CALL PGM(X)
```

When program X acquires program device PGMDEV1 for an ICF file, the remote location MPLS and attributes from override 4 are used. Because override 4 specifies SECURE(*YES), override 1 is not applied.

Deleting Device Entry Overrides

When a program returns from a call level containing program device entry overrides, the overrides are deleted, just as any file overrides are deleted. When control is transferred to another program (TFRCTL command) so that the program is running at the same call level, the overrides are not deleted. If you want to delete an override before the run is completed, you can use the Delete Override Device Entry (DLTOVRDEVE) command. This command only deletes overrides in the call level in which the command is entered. A DLTOVRDEVE command does not delete the effects of an ADDICFDEVE command. To remove an ADDICFDEVE command, you must use the Remove Intersystem Communications Function Program Device Entry (RMVICFDEVE) command. To identify an override, use the program device name specified on the PGMDEV parameter of the override. You can delete all overrides at this call level by specifying value *ALL for the PGMDEV parameter. For example:

```
Override 1          OVRICFDEVE PGMDEV(PGMDEV1) +
                      RMTLOCNAME(BOSTON)
Override 2          OVRICFDEVE PGMDEV(PGMDEV4) +
                      RMTLOCNAME(ROCHMN)
Override 3          OVRICFDEVE PGMDEV(PGMDEV5) +
                      RMTLOCNAME(NYC)
Delete Override 1   DLTOVRDEVE PGMDEV(PGMDEV1)
Delete Override 2   DLTOVRDEVE PGMDEV(*ALL)
```

Delete override 1 causes override 1 to be deleted. Delete override 2 causes the remaining overrides (overrides 2 and 3) to be deleted.

Displaying Device Entry Overrides

Device entry overrides are not displayed by the Display Override (DSPOVR) command. There is no corresponding command to display device entry overrides.

Chapter 4. Copying Files

You can use the copy function to move data between device files, database files, or device and database files. Unlike traditional copy utilities, the AS/400 copy function is field-level sensitive. Therefore, if you use the copy function, you can rearrange, enlarge, or drop any of the fields. The system also provides a way to define database files. Specific copy commands simplify dealing with tape and diskette units, database source files, and open query files.

You can copy records to and from files using the following commands:

CPYF
: Copy File: Copies all or part of a file from the database or external device to the database or external device.

CPYFRMDKT
: Copy from Diskette: Copies from a diskette file to a database or device file. The from-file must be a diskette file for this command, but the to-file can be a physical, program-described printer, tape, or diskette file. You can obtain a formatted listing of the records using the IBM-supplied printer file, QSYSPRT.

CPYTODKT
: Copy to Diskette: Copies a database or device file to a diskette file. The to-file must be a diskette file. The from-file can be a physical, logical, tape, diskette, or inline data file.

CPYFRMTAP
: Copy from Tape: Copies from a tape file to a database or device file. The from-file must be a tape file, but the to-file can be a physical file, diskette file, tape file, or program-described printer file. You can obtain a formatted listing of the records using QSYSPRT.

CPYTOTAP
: Copy to Tape: Copies from a database or device file to a tape file. The to-file must be a tape file, but the from-file can be a physical, logical, diskette, tape, or inline data file.

CPYSRCF
: Copy Source File: Copies a database source file to a source physical file and converts the data in the from-file to the to-file CCSID. A formatted listing can be created using QSYSPRT (the file is changed for source records and is different from other copy command file formats). Record data is copied from the from-file to the to-file, disregarding differences in record formats (similar to the FMTOPT(*NOCHK) parameter option on the CPYF command, except for the CCSIDs.)

CPYFRMQRYF
: Copy from Query File: Copies an open query file to a database or device file.

If you specify a DDM file and a local file on the CPYF or CRYSRCF commands, the system does not verify that the remote and local files are not the same file on the source system. If one DDM file is specified, a user can potentially copy to and from the same file.

For information on how to copy DBCS-open fields to graphic fields (including the option of removing trailing single-byte blanks for the DBCS-open field first), see "DBCS-Graphic Fields" on page 4-33.

Throughout this chapter, unless a specific command is mentioned, the term **copy commands** refers to all the commands just described.

The device and database files where copy operations may be performed are shown in Table 4-1 on page 4-2.

Table 4-1. Copy Operations

From-Files	To-Files
DDM	DDM
Diskette[1]	Diskette[1]
Logical	Physical[2]
Open Query[3]	Printer
Physical	*PRINT[4]
Inline Data[5]	Tape
Tape	

1 If the from-file and the to-file are both diskette files, the to-file must be spooled.

2 If the to-file does not exist before the copy operation, the copy operation will create a physical file as the to-file if you specified:

- CRTFILE(*YES) on the CPYF command and the from-file is a physical or logical file.
- CRTFILE(*YES) on the CPYFRMQRYF command.

3 Open query files can only be copied by using the CPYFRMQRYF command. CPYFRMQRYF is not allowed for open query files that use DDM files.

4 If TOFILE(*PRINT) is specified, the from-file records are copied to the IBM-supplied printer device file QSYSPRT and formatted according to the OUTFMT parameter.

5 An inline data file (which is handled like a device file) is included as part of a batch job when the job is read by a reader program.

While copying records, some of the copy commands can perform the following functions:

- Copy from or to the first file member, a particular file member, a generic set of members, or all file members (FROMMBR and TOMBR parameters).
- Add a member to a physical to-file if the member does not exist.
- Add records to an existing file member or replace the contents of an existing member (MBROPT parameter).
- Select certain records to copy by one of the following methods:
  - Selecting records by record format name when a multiformat logical file is copied (RCDFMT parameter).
  - Specifying records starting at a relative record number and/or ending at a relative record number (FROMRCD and TORCD parameters).
  - Specifying records starting with a specific record key value and/or ending with another specific record key value (FROMKEY and TOKEY parameters).
  - Specifying the number of records to be copied (NBRRCDS parameter).
  - Selecting records by the contents of one or more character positions in the record or in a field in the record (INCCHAR parameter).
  - Selecting records by the values contained in one or more fields in the record (INCREL parameter).
  - Disregard or include deleted records in the from-file during the copy if processing the from-file in arrival sequence (COMPRESS parameter).
- Print copied records and/or excluded records (PRINT parameter) in a specified format (OUTFMT parameter).

- Copy records whose from-file and to-file record formats are different (FMTOPT parameter). When formats are different, you can:
  - Map fields whose names are the same in the from-file and to-file record formats and whose field attributes are compatible (*MAP value).
  - Drop fields in the from-file record format that do not exist in the to-file record format (*DROP value).
  - Copy data directly (left to right) disregarding any differences (*NOCHK value).
- Copy from a source file to a data file or from a data file to a source file. If the from-file or to-file is a device file, this function is automatic. If both files are database files, FMTOPT(*CVTSRC) is required.
- Change sequence numbers and/or zero dates in the sequence number and date source fields when copying to a source physical file (SRCOPT parameter). When renumbering is to be done, the starting sequence number and the increment value can be specified (SRCSEQ parameter).
- End the copy after a specified number of recoverable errors are encountered (ERRLVL parameter).
- Create the to-file as part of the copy operation (CRTFILE parameter).

Refer to the following tables (Table 4-2 and Table 4-3 on page 4-5) for a summary of what specific copy functions (using the copy commands) can be used for copying records by the types of files being copied from and to. The functions with their associated parameters are listed down the left side, and the file types (and if each can be a from-file and/or a to-file) are shown across the top. An X indicates that the associated parameter is valid for the type and use of file under which it occurs.

See the *CL Reference* manual for the specific parameters supported by each copy command.

Table 4-2. Summary of Copy Functions for Database Files

		Database Files[1]			
		Physical		Logical	
Copy Function	**Parameter**	**From**	**To**	**From**	**To**
Select files	FROMFILE[2]	X		X	
	TOFILE		X		
Select members	FROMMBR	X		X	
	TOMBR		X		
Add to or replace existing records	MBROPT		X		
Create the to-file	CRTFILE[3]	X	X	X	
Print copied and/or excluded records	PRINT[4]	X	X	X	
Select by record format	RCDFMT			X	
Select by relative record number	FROMRCD	X		X[5]	
	TORCD	X		X[5]	
Select by key field value	FROMKEY	X		X	
	TOKEY	X		X	
Specify number of records to copy	NBRRCDS	X		X	
Select by character content	INCCHAR	X		X	
Select by field value	INCREL	X		X	
Process different database record formats	FMTOPT	X	X	X	
Update sequence number and/or date	SRCOPT	X	X	X	
Specify start value and increment	SRCSEQ	X	X	X	
Print character and/or hex format	OUTFMT[4]	X	X	X	
Maximum recoverable errors allowed	ERRLVL	X	X	X	
Disregard or include deleted records	COMPRESS[6]	X	X		

1 DDM files will appear to act like database files, with exceptions noted in the *DDM Guide*.

2 On the CPYFRMQRYF command, the FROMOPNID parameter is used to identify an open identifier for the open query file to be copied from. The FROMFILE parameter is used in all other copy commands.

3 If the to-file does not exist before the copy operation and the from-file is a physical or logical file, the copy operation will create a physical file as the to-file if you specified CRTFILE(*YES) on the copy commands.

4 You can specify a program-described printer file so that the copy will produce a list with no special formatting or page headings, or you can specify TOFILE(*PRINT) to produce a formatted list. You can specify PRINT(*COPIED) to produce a formatted list of the copied records, and you can specify PRINT(*EXCLD) to produce a formatted list of the records excluded by the INCCHAR or INCREL parameters. When you request a list by specifying the TOFILE(*PRINT) parameter, the OUTFMT parameter specifies whether the data is printed in character or in both character and hexadecimal form.

5 You can specify the FROMRCD and TORCD parameter values for a logical file if it has an arrival sequence access path.

6 You cannot specify COMPRESS(*NO) if:

- The to-file member or a logical file member based on the to-file member has a keyed access path with any of the following attributes:
  - Unique keys (UNIQUE keyword specified in the DDS)
  - Floating-point key field or logical numeric key field and not MAINT(*REBLD)
  - Select/omit specifications in the DDS (without the DYNSLT keyword specified) and not MAINT(*REBLD)
- Field-level mapping or source/data conversion is required (FMTOPT parameter).
- An EOFDLY wait time is specified for the from-file on an Override Database File (OVRDBF) command.

Note: To copy deleted records, the from-file must be processed in arrival sequence.

Table 4-3. Summary of Copy Functions for Device Files

Copy Function	Parameter	Device Files: Inline Data From	Inline Data To	Diskette From	Diskette To	Tape From	Tape To	Printer From	Printer To
Select files	FROMFILE	X		X[1]		X			
	TOFILE				X[1]		X		X
Select members	FROMMBR			X		X			
	TOMBR				X		X		
Add to or replace existing records	MBROPT								
Create the to-file	CRTFILE								
Print copied and/or excluded records	PRINT[2]	X		X	X	X	X		X
Select by record format	RCDFMT								
Select by relative record number	FROMRCD	X		X		X			
	TORCD	X		X		X			
Select by key field value	FROMKEY								
	TOKEY								
Specify number of records to copy	NBRRCDS	X		X		X			
Select by character content	INCCHAR	X		X		X			
Select by field value	INCREL								
Process different database record formats	FMTOPT								
Update sequence number and/or date	SRCOPT								
Specify start value and increment	SRCSEQ								
Print character and/or hex format	OUTFMT[2]	X		X	X	X	X		X
Maximum recoverable errors allowed	ERRLVL					X			
Disregard or include deleted records	COMPRESS								

1 If the from-file and to-file are diskette files, you must specify that the to-file be spooled [SPOOL(*YES)] on a CRTDKTF, CHGDKTF, or OVRDKTF command.

2 You can specify a program-described printer file so that the copy will produce a list with no special formatting or page headings, or you can specify TOFILE(*PRINT) to produce a formatted list. You can specify PRINT(*COPIED) to produce a formatted list of the copied records, and you can specify PRINT(*EXCLD) to produce a formatted list of the records excluded by the INCCHAR or INCREL parameter. When you request a list by specifying the TOFILE(*PRINT) parameter, the OUTFMT parameter specifies whether the data is printed in character or in both character and hexadecimal form.

Basic Copy Function

As indicated in Table 4-2 on page 4-4 and Table 4-3, you can copy from a physical or logical database file, open query file, diskette file, tape file, or inline data file. The to-file can be a physical database file, diskette file, tape file, program-described printer file, or *PRINT. When TOFILE(*PRINT) is specified, the CPYSRCF command uses a different format from the other copy commands. This format is organized to show source information in a more readable format and for multiple member copies, the members are copied and listed in alphabetical order.

If you are copying from a database file and the to-file does not exist, you must specify CRTFILE(*YES) and identify the file name and library name on the TOFILE parameter in order to create the to-file. You cannot copy from a diskette to a diskette unless the to-file is spooled and a diskette spooling writer is not active.

The from-file (not including the CPYFRMQRYF command where the from-file is not opened), to-file, and the QSYSPRT printer file (if TOFILE(*PRINT), PRINT(*COPIED), or PRINT(*EXCLD) is specified) are opened with the SHARE(*NO) attribute. Because the copy may not function correctly with a shared file, it will end with an error message if the from-file, to-file, or QSYSPRT printer file is overridden to SHARE(*YES) and the file has already been opened in the job.

If you specify TOFILE(*PRINT), the records are copied to the IBM-supplied printer file QSYSPRT, and the list is formatted by the OUTFMT parameter.

If you do not want a formatted list or if you want to use first-character forms control (CTLCHAR(*FCFC) on the Create Printer File (CRTPRTF) or Override with Printer File (OVRPRTF) command), you should specify a program-described printer file name (such as QSYSPRT) instead of *PRINT on the TOFILE parameter.

File Types

When the from-file and to-file are different types (source and data), the following is true. For the CPYFRMQRYF command, the from-file is always treated as a data file:

- If the from-file or to-file is a device file (or an inline data file), the copy function will automatically add or delete the source sequence number and date fields for each record copied.
- If the from-file and to-file are database files, you must specify FMTOPT(*CVTSRC) to perform the operation. The sequence number and date fields are added or deleted as they are for a device file, and the data part of each record is copied without regard to the field definitions in the file record formats. For a source physical to-file, the SRCSEQ parameter can be used to control how sequence numbers are created if SRCOPT(*SEQNBR) is also specified.

Record Sequence

The sequence in which records are organized in a database file is called the **access path**. There are two types of access paths: **keyed sequence** and **arrival sequence**. With the copy function, you can process records in a database file in either arrival sequence or keyed sequence. An arrival sequence copy transfers records in the order in which they physically exist in the from-file. This order is represented by relative record numbers. The relative record number is the position where the records physically exist in storage. Because records are always added to the end of the file, the relative record number represents the order in which records arrived in the file.

A keyed sequence copy selects and transfers records by key value from a keyed physical file. This may result in a different physical order in the to-file. The to-file will be a reorganized version of the from-file. The relative record number of a specific record may change when a file is copied by key value:

Relative Record Number	Arrival Sequence	Keyed Sequence
1	1011	0016
2	0762	0762
3	0810	0810
4	3729	1011
5	0016	3729

You can copy a keyed physical file in arrival sequence by specifying the FROMRCD or TORCD parameter on the copy commands. When you do this, the keyed sequence access path is not used to retrieve the records in key sequence. The records are retrieved in arrival sequence. This is helpful when the physical relative record location in the file is significant and needs to remain the same as it is in the original file. Specifying FROMRCD(1) is a good way to copy all the records in arrival sequence. Copying a physical file in arrival sequence instead of keyed sequence is also faster.

The kind of copy you run is determined by the type of from-file and the method of selecting records to copy. In general, files are copied using their keyed sequence, if they have one, otherwise, their arrival sequence. For more information on the selection methods, refer to "Selecting Records to Copy" on page 4-16.

A copy from a keyed file to a keyed file usually places records at the end of the to-file in key field order, by the from-file key, regardless of their physical order in the from-file. But if you select records in the from-file by relative record number (using the FROMRCD or TORCD parameter), they are physically placed at the end of the to-file in relative record number order, regardless of their keyed sequence in the from-file. The following example shows the result of a copy command specifying from record 3 to record 5:

FROM-FILE			TO-FILE	
Relative Record Number	Key		Relative Record Number	Key
1	1011		·	---
2	0762		·	---
3	0810	Arrival	1401	0810
4	3729	Sequence	1402	3729
5	0016	Copy	1403	0016

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When the to-file has a keyed sequence, the records appear in correct order in the to-file when using the keyed sequence access path. A copy by relative record number always copies by arrival sequence.

Resending Copy File Completion Message

If a copy command is run from a CL program, the completion message indicating the number of records copied is not sent directly to the system operator. You can direct this message to the system operator by resending it (SNDPGMMSG command) from the CL program, using the following CL program as an example:

```
PGM
DCL &MSGID TYPE(*CHAR) LEN(7)
DCL &MSGDTA TYPE(*CHAR) LEN(82)
CPYF FROMFILE(LIB1/XXX) TOFILE(LIB2/XXX) +
  MBROPT(*ADD)
RCVMSG MSGID(&MSGID) MSGDTA(&MSGDTA) +
  MSGTYPE(*COMP) RMV(*NO)
SNDPGMMSG MSGID(&MSGID) MSGF(QCPFMSG) +
  MSGTYPE(*INFO) TOMSGQ(QSYSOPR) +
  MSGDTA(&MSGDTA)
ENDPGM
```

The copy function sends one of the following completion messages for each from-file member/label successfully copied to the to-file:

- CPC2955 is the normal copy completion message.
- CPC2956 is used when COMPRESS(*NO) is specified.
- CPC2957 indicates that no records were copied.

Monitoring for Copy Errors

The escape message CPF2817 is sent to indicate many different error conditions. Except for the empty from-file member case which is described later, when this message is sent:

- A physical file is not created (even if CRTFILE(*YES) was specified on a copy command).
- No members are added to a to-file that is a physical file.
- No to-file member is cleared (even if MBROPT(*REPLACE) was specified).
- The to-file is not opened, so no file is created on a diskette or tape volume. If the to-file is spooled, no spooled file is created.
- No records are copied.

The CPF2817 escape message is always preceded by at least one diagnostic message that indicates the specific error condition. The message identifier of the diagnostic message which immediately precedes the CPF2817 escape is used as message replacement data (MSGDTA parameter on the SNDPGMMSG command) for the CPF2817 escape message. This allows you to monitor for specific error cases from the CPF2817 escape message by using the CMPDTA parameter on the MONMSG command.

For example, message CPF2802 is a diagnostic that indicates the from-file cannot be found. You can monitor for just the `from-file not found` condition as follows:

```
PGM
          /* The replacement text of escape
          CPF2817 contains the msg ID
          CPF2802 for the 'from-file not
          found' condition */
CPYF  FROMFILE(NOLIB/NOFILE) TOFILE(D504/KEY) +
  FROMMBR(NOMBR) TOMBR(MBR1) MBROPT(*ADD)
MONMSG MSGID(CPF2817) CMPDTA(CPF2802) +
  EXEC(SNDPGMMSG TOPGMQ(*EXT) +
  MSG('File NOFILE in NOLIB not found'))
ENDPGM
```

Any error other than `from-file not found`, including any other error reported with a CPF2817 escape message, causes a function check in this program because the MONMSG command applies only to the CPF2817 escape when it has the compare data from message CPF2802.

If you are running the CPYFRMQRYF command, it does not normally close the open query file after completing the copy. However, if you are running the CPYFRMQRYF command from a command entry line, any error messages occurring after the OPNQRYF command is successfully run will close the file unless TYPE(*PERM) was specified on the OPNQRYF command. The system automatically runs a Reclaim Resources (RCLRSC) command if an error message occurs. If the OPNQRYF command specified TYPE(*PERM), the file is not automatically closed by the system.

The following messages can be sent as diagnostic messages immediately followed by a CPF2817 escape message. Some of these messages can also be sent as other message types (such as an informational or escape message). When the message is sent as a diagnostic message type, the message identifier appears in the replacement text of the CPF2817 escape message. You can monitor the condition by using the CMPDTA parameter on the MONMSG command:

CPD2968	CPF2813	CPF2844	CPF2874
CPD2969	CPF2814	CPF2847	CPF2877
CPD2970	CPF2816	CPF2848	CPF2878
CPD2971	CPF2819	CPF2849	CPF2879
CPD2972	CPF2820	CPF2851	CPF2881
CPD2973	CPF2821	CPF2853	CPF2883
CPD2974	CPF2822	CPF2854	CPF2884
CPD2975	CPF2823	CPF2855	CPF2890
CPD2976	CPF2825	CPF2856	CPF2891
CPD2979	CPF2826	CPF2857	CPF2893
CPD2980	CPF2827	CPF2860	CPF2960
CPD2981	CPF2831	CPF2861	CPF2962
CPF2801	CPF2832	CPF2862	CPF2963
CPF2802	CPF2833	CPF2863	CPF2965
CPF2803	CPF2834	CPF2864	CPF2969
CPF2804	CPF2836	CPF2865	CPF9807
CPF2805	CPF2837	CPF2868	CPF9808
CPF2806	CPF2839	CPF2869	CPF9820
CPF2808	CPF2840	CPF2870	CPF9830
CPF2810	CPF2841	CPF2871	
CPF2811	CPF2842	CPF2872	
CPF2812	CPF2843	CPF2873	

Monitoring for Zero Records in the From-File

There are some special considerations for copy when the from-file is a physical or logical file and one or more members to be copied are empty. A member is considered empty in the following cases:

- If COMPRESS(*NO) is specified on the CPYF command and the from-file member contains no records.
- If COMPRESS(*YES) is specified or assumed for any copy command and the from-file members contain no undeleted records.

Members copied involving record selection (CPYFRMQRYF command or the INCCHAR and INCREL parameters of the CPYF command) that produce no records are not considered empty.

When the to-file is a printer file (including *PRINT), or when the to-file is a physical file and MBROPT(*ADD) is specified, empty from-file members are copied because no existing data will be destroyed. Each member copied is identified by a normal copy completion message. If the to-file is spooled, an empty spooled file is produced for each empty from-file member. If the CPYF command PRINT parameter specifies *COPIED or *EXCLD, the empty members are shown in the lists with no records printed.

Except for the CPYFRMQRYF command, an empty from-file member is never copied to a diskette or tape file, or to a physical file when MBROPT(*REPLACE) is specified. Empty from-file members are skipped for these types of to-files, and a CPF2869 message is sent (as either an informational or diagnostic message) to identify each empty member. The empty members are skipped to avoid destroying existing data. When an empty from-file member is skipped, the following considerations apply:

- A tape or diskette file is not produced on the output volume. If the diskette file is spooled, no spool output file is created.
- An existing to-file physical file member is not cleared.
- If the to-file does not exist and CRTFILE(*YES) was specified on a copy command, a physical file is created.
- If the to-file is a physical file and the to-file member does not exist, a member is added to the file.
- If the CPYF command PRINT parameter specifies *COPIED or *EXCLD, the empty members are not shown in the lists.

When the copy command specifies a generic name or *ALL for the FROMMBR parameter, each empty from-file member skipped is identified by message CPF2869, sent as an informational message. If all the from-file members are skipped, a CPF2870 diagnostic message is sent after all the CPF2869 informational messages, followed by a CPF2817 escape message.

When the copy command specifies a single member name or *FIRST for the FROMMBR parameter, or when there is an override for the from-file that forces a single member to be processed, an empty member that is skipped is identified by message CPF2869 sent as a diagnostic message. The CPF2869 diagnostic message is followed by a CPF2817 escape message.

In the following example, the from-file and to-file are both database files and EMPTY1 and EMPTY2 are empty members in the from-file.

```
PGM
          /* No need to monitor for zero records
             when MBROPT(*ADD) specified    */
CPYF    FROMFILE(D504/GEORGE) TOFILE(D504/KEN) +
  FROMMBR(EMPTY1) TOMBR(MBR1) MBROPT(*ADD)
CPYF    FROMFILE(D504/GEORGE) TOFILE(D504/KEN) +
  FROMMBR(EMPTY2) TOMBR(MBR2) MBROPT(*REPLACE)
MONMSG  MSGID(CPF2817) CMPDTA(CPF2869) +
  EXEC(CLRPFM  FILE(D504/KEN) MBR(MBR2))
          /* Monitor for zero records and
             send a message when all members
             to copy are empty */
CPYF    FROMFILE(D504/GEORGE) +
  TOFILE(D504/NEWFILE) FROMMBR(EMPTY*) +
  TOMBR(NEWMBR) MBROPT(*REPLACE)
MONMSG  MSGID(CPF2817) CMPDTA(CPF2870) +
  EXEC(SNDPGMMSG TOPGMQ(*EXT) +
  MSG('All members to copy are empty'))
ENDPGM
```

For the first CPYF command, MBROPT(*ADD) is specified, so an escape message is not sent to the program because of the empty from-file member. Note that if MBR1 does not exist before the copy, it is added to the to-file (if either the from-file member is empty or contains data).

For the second CPYF command, copy does not clear the to-file member when the from-file member is empty, so the MONMSG command after the second CPYF command starts the CLRPFM command to clear the to-file member when the from-file member is empty.

For the third CPYF command, the CPF2817 escape message has compare data of CPF2870 if all members to be copied are empty because the generic from-file member name, EMPTY*, requests that multiple members be copied.

Creating a Duplicate To-File Member

When your application requires an exact duplicate of the records in the to-file member (if either the from-file is empty or contains data), an alternative solution is to use the Clear Physical File Member (CLRPFM) command:

```
CLRPFM FILE(X) MBR(XYZ)
CPYF FROMFILE(Y) TOFILE(X) TOMBR(XYZ) +
     MBROPT(*ADD)
```

Because MBROPT(*ADD) is specified, the CPYF command completes normally even if there is no data in file Y. MBR(XYZ) in file X contains an exact duplicate of the records in the member in file Y.

CPYFRMQRYF Command Support for CCSIDs

The Copy from Query File (CPYFRMQRYF) command provides CCSID conversions for character and DBCS fields. The Open Query File (OPNQRYF) command converts all character and DBCS fields to the current job CCSID, except for fields that have a CCSID of 65535 or where *HEX is specified on the MAPFLD parameter. If the current job CCSID is 65535, then no conversions are done by OPNQRYF. The CPYFRMQRYF command may also do conversions to the to-file field CCSIDs, so it is possible that double conversions will be done and data may be lost. To avoid the possibility of doing double conversions, change the job CCSID to 65535 before doing an OPNQRYF if you plan to do a CPYFRMQRYF.

CPYFRMQRYF uses a modified query format, which is the same as the open query file format except for the CCSIDs for character and DBCS fields. The CCSIDs in the modified query format are determined according to the following:

- If the OPNQRYF job CCSID is 65535, all character and DBCS fields in the modified query format have the same CCSIDs as the open query file format.
- If the OPNQRYF job CCSID is not 65535, all character and DBCS fields in the modified query format have their CCSIDs reset to the

associated single-byte, mixed or double-byte CCSIDs of the OPNQRYF job CCSID, based on the field type. Fields with a CCSID of 65535 remain unchanged. If there is no associated mixed or double-byte CCSID for the OPNQRYF job CCSID, 65535 is used.

More information on CCSIDs can be found in the *National Language Support Planning Guide*.

CPYSRCF Command Support for CCSIDs

Using the Copy Source File (CPYSRCF) command automatically converts data in the from-file to the to-file CCSID. If you do not want the character data converted, use the CPYF command with FMTOPT(*NOCHK).

Copy Commands Support for Null Values

You can copy files containing null-capable fields using the CPYF and CPYFRMQRYF commands. The FMTOPT parameter allows mapping of null-capable fields. The INCREL parameter allows selection of records based on whether a field is or is not null.

While copying the records to the to-file, the following commands ignore null values in the from-file:

CPYTOTAP	CPYTODKT
CPYFRMTAP	CPYFRMDKT

The following conditions or values on the CPYF or CPYFRMQRYF command ignore null values in the from-file while copying the records to the to-file:

FMTOPT(*NOCHK)
FMTOPT(*CVTSRC)
Device to-file

Record selection involving null values may still be done, but only the user-specified or default value in the buffer (rather than a null value) is copied to the to-file. Null values cannot be preserved in these instances. Any print listings produced when a copy command is run (including TOFILE(*PRINT), PRINT(*COPIED), and PRINT(*EXCLUDE)) also ignore null values.

Adding and Replacing Records (MBROPT Parameter)

(CPYF, CPYFRMDKT, CPYFRMQRYF, CPYFRMTAP, and CPYSRCF commands)

To copy to a physical file, you must either specify on the MBROPT parameter that copied data (for the to-file member) is to be added to (*ADD), or entirely replace (*REPLACE) existing data (in the to-file member). The default value for the CPYSRCF command is *REPLACE, which clears existing records in the receiving member of the to-file before replacing them with records copied from the from-file. On copy commands other than CPYSRCF, the default value *NONE is valid only for copying to a device file.

By specifying *REPLACE, you essentially clear the member. The copied records are the only records in the member when the operation is completed. You must have authority to clear the member in order to specify MBROPT(*REPLACE).

When you specify *ADD, each record copied is added to the end of the existing records in the member. It is important to note that this is always true, even for keyed files, though with keyed files, the added records appear to be merged in key sequence when accessed through a keyed access path. When copying from query files, the relative record numbers of the resulting file may not correspond to those in the original file.

When *ADD is specified, the copy completes normally even if the from-file contains no records.

For copy commands except the CPYFRMQRYF command, when *REPLACE is specified, copy command processing fails if the from-file does not contain any records. When *REPLACE is specified on the CPYFRMQRYF command, the to-file member will be cleared if the open query file contains no records. For three copies with MBROPT(*ADD) to a database file that is not keyed, the resulting to-file would look like Figure 4-1.

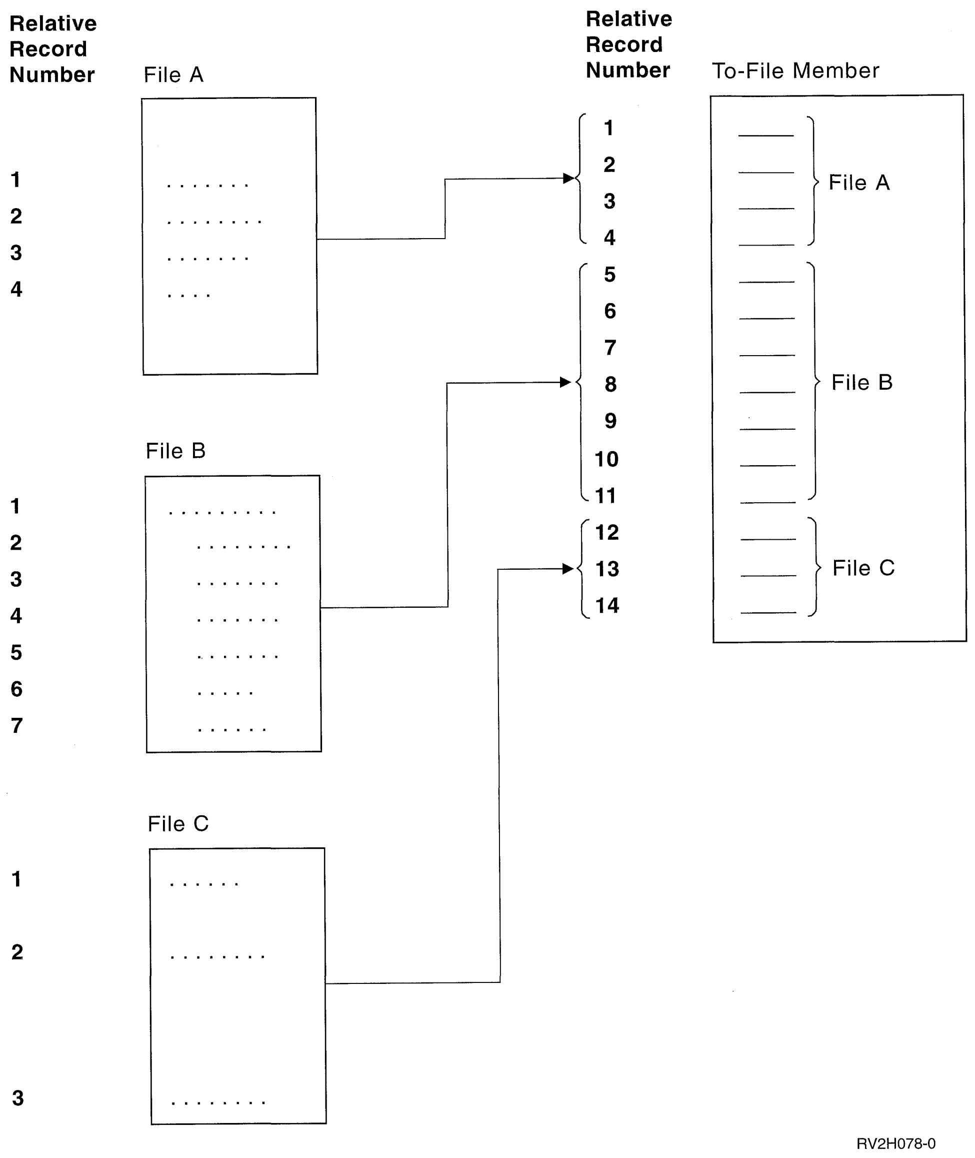
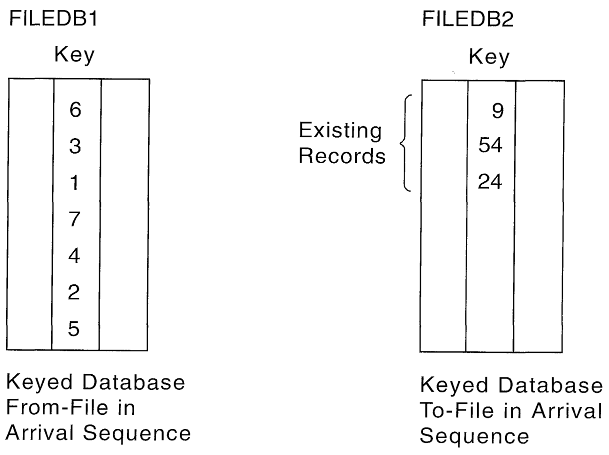


*Figure 4-1. Result of Copies with MBROPT(*ADD) Specified*

See “Adding or Changing Source File Sequence Number and Date Fields (SRCOPT and SRCSEQ Parameters)” on page 4-35 for source file considerations in this operation, and “Copying Deleted Records (COMPRESS Parameter)” on page 4-23 for considerations for deleted records.

If MBROPT(*ADD) is specified, records are always physically added at the end of the file, even if it is a keyed sequence file. In the following illustration, FILEDB1 is a keyed physical from-file, and FILEDB2 is a keyed physical to-file. The files are shown as they physically appear in storage. FILEDB2 already has three records in it.


FILEDB1
Key
6
3
1
7
4
2
5
Keyed Database From-File in Arrival Sequence
FILEDB2
Key
Existing Records
9
54
24
Keyed Database To-File in Arrival Sequence

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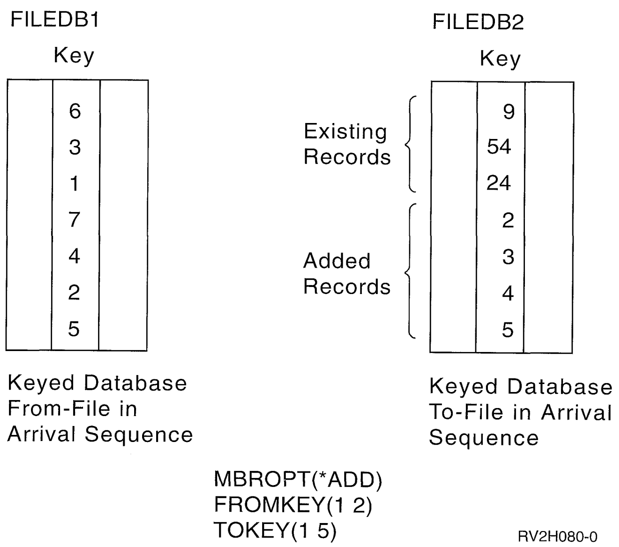
If you specify MBROPT(*ADD), FROMKEY(1 2), and TOKEY(1 5), four records are added in key field order to the end of FILEDB2 as shown in the following figure.



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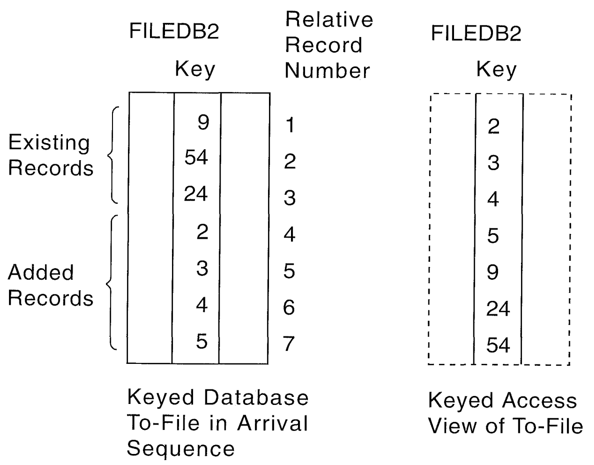
The added records, however, appear to be merged in the new file when viewed through a keyed sequence access path as shown in the following figure.



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Several ways to select records for copying are explained in this chapter. One method is selection by relative record number. (See “Selecting Records Using Relative Record Numbers (FROMRCD and TORCD Parameters)” on page 4-17.) Using the preceding example, if you selected records to copy to a third file from FILEDB2 by relative record number, from number 3 through 5, you would copy the records with a key value of 24, 2, and 3, not 4, 5, and 9.

Creating the To-File (CRTFILE Parameter)

(CPYF and CPYFRMQRYF commands)

To copy a physical or logical file when there is no existing to-file to receive the data, you can create the to-file by specifying CRTFILE(*YES). The name of the new to-file is specified on the TOFILE parameter and must be qualified with the name of an existing library for which you have the required authority.

If copy is used to create the to-file, then the to-file specified cannot be overridden to a different file or library.

If the from-file is a logical file or if CPYFRMQRYF is used, any variable-length fields in the physical file created by the copy operation have an allocated length of zero.

CRTFILE(*YES) also adds members in the newly created file. See the section on adding members later in this chapter.

Because no records exist in the newly created file and member, the MBROPT parameter is ignored, and records are automatically added to the new file. An error occurring during copy processing after a file is created and/or members are added has no effect on the newly created file and/or added members. If the CPYF command is used, the to-file that is created has the same record format and type of access path as the from-file. The text of the from-file is used as the text for the to-file. The text of from-file members that are copied is used as the text of any to-file members created. If the from-file is a logical file with multiple record formats, the to-file is created with the record format specified on the RCDFMT parameter on the CPYF command. (See "Selecting Records Using a Specified Record Format Name (RCDFMT Parameter)" on page 4-16.) When the from-file is a logical file, the following physical file attributes are assigned by the system: SIZE(*NOMAX), ALLOCATE(*NO), and CONTIG(*NO). If the from-file is a logical file and its keyed access path was created with the *NONE keyword specified for all key fields in the source DDS, then the physical to-file is created with an arrival sequence access path.

When copying from a query file to create a physical file, the file is given attributes applicable to a physical file that match the first file specified on the FILE parameter for the OPNQRYF command. However, some of the attributes are assigned by the system. The file is created with CONTIG(*NO), SIZE(*NOMAX), ALLOCATE(*NO), AUT(*NORMAL), and FILETYPE(*DATA). The file is created with a single format using the modified query format. See "CPYFRMQRYF Command Support for CCSIDs" on page 4-9. The name, type, length, null capability, date or time format, separators, and decimal positions attributes of each field in the format specified are used. Other field attributes are not used. The file is created without key fields and is an arrival sequence physical file.

If you specify CRTFILE(*YES) on the Copy File (CPYF) command, the file level and the format level identifiers of the new to-file are identical to the file level and the format level identifiers of the from-file.

If you specify CRTFILE(*YES) on the Copy From Query File (CPYFRMQRYF) command, the file level and the format level identifiers of the new to-file are generated at the time the new to-file is created. In most cases, the format level identifier of the new to-file is the same as the format level identifier of the format specified in the FORMAT parameter of the Open Query File (OPNQRYF) command. In some cases, the OPNQRYF command changes the format of the new to-file. For example, the format of the new to-file may become null-capable when the OPNQRYF command uses one of the following grouping functions:

- %STDDEV
- %VAR
- %SUM
- %AVG
- %MIN
- %MAX

A new to-file with a changed format has a format level identifier that is different from the format level identifier specified in the OPNQRYF command.

For copy to create a physical file for the to-file, you must have authority to the Create Physical File (CRTPF) command.

When a local physical file is created by the Copy File (CPYF) command, the created to-file is given all the authorities of the from-file. These authorities include public, private, and authorization lists.

When a local physical file is created by the Copy from Query File (CPYFRMQRYF) command, the created to-file is given all the authorities of the first file specified on the FILE parameter of the corresponding Open Query File (OPNQRYF) command. The authorities include public, private, and authorization lists.

In both cases (CPYF and CPYFRMQRYF), the owner of the created to-file is the user profile running the copy command. This is true unless the user is a member of a group profile and has OWNER(*GRPPRF) specified for the profile. If the user profile specifies OWNER(*GRPPRF), the group profile becomes the owner of the to-file. In this case, if the user profile running the copy command does not have sufficient authority to add a member or write data to the new file, then the copy command fails. When the created to-file is owned by the user running the copy command, the user inherits *ALL authority to the object.

The created to-file does not maintain the file capabilities of the from-file. The to-file allows update, delete, read, and write operations, regardless of whether these operations were allowed on the from-file.

If the number of records copied into a member is greater than the maximum size of the created to-file, the to-file is extended without intervention by the system operator.

If the from-file is an SQL table, the created to-file will be a physical file that is not an SQL table.

Selecting Members or Labels to Copy (FROMMBR, FROMLABEL, TOMBR, and TOLABEL Parameters)

Table 4-4 on page 4-15 lists the commands where the parameters relating to selecting members or labels to copy are valid.

For database files, you can specify the name of the from-file member to be copied on the FROMMBR parameter and the name of the to-file member that is to receive the copied records on the TOMBR parameter. A special value *FIRST can also be specified to copy from or to the first member (in creation order) in the database file.

| For diskette or tape files, you can specify the label identifier of the data file to be copied on the FROMMBR or FROMLABEL parameter and the label identifier of the data file that is to receive the copied records on the TOMBR or TOLABEL parameter. If the special value *FIRST, *DKTF, or *TAPF is specified on the copy command, then the label from the device file description is used.

If TOMBR (*FIRST) is specified and the to-file is a diskette or tape file, no label identifier is specified by the copy operation. Therefore a label identifier (LABEL parameter) must be specified in the device file on an OVRDKTF command (for a diskette file), or on an OVRTAPF command (for a tape file).

If the from-file is a database or diskette file, a generic name can be specified on the FROMMBR or FROMLABEL parameter. All members or labels that start with a character string you specified for the generic name are copied. To specify a generic name, enter the starting character string that each member/label has in common, and follow it with an * (asterisk). For example, if you specified FROMMBR(ORD*), all database members or diskette labels starting with ORD would be copied.

If a generic name is specified for the FROMLABEL parameter on the CPYFRMDKT command and a LABEL parameter value is also specified on an Override Diskette File (OVRDKTF) command, only the single-file label identifier specified on the override is copied.

You can also indicate on the FROMMBR or FROMLABEL parameter that you want to copy all the members from a database file or all the labels from a diskette file by specifying special value *ALL. If FROMLABEL(*ALL) is specified on the CPYFRMDKT command and a LABEL parameter value is also specified on an OVRDKTF command, only the single-file label identifier specified in the override is copied.

You can copy a generic set or all members/labels in the following copy operations:

Diskette To:	Database To:
Database (physical file)	Database (physical file)
Diskette (Note 1)	Diskette
Tape (Note 2)	Tape (Note 2)
Printer	Printer
*PRINT	*PRINT

Notes:

1. The to-file must be spooled for diskette-to-diskette copy operations.
2. Multiple from-file members or labels can only be copied to a single tape file label.

If a generic set or all labels are being copied from a diskette and a label *being copied* is continued on another diskette volume, then all the labels on the continuation volume are copied (or checked if they should be copied where a generic label was specified).

Multiple database members or diskette labels can be copied to corresponding like-named to-file members or labels. They can also be copied and concatenated, one after another, into a single to-file member or label. If the to-file is a spooled file, then each member/label is copied to a separate spooled file. If TOFILE(*PRINT) is specified,

Table 4-4. Valid Member or Label Parameters for Copy Commands

	FROMMBR[1]	FROMLABEL	TOMBR	TOLABEL
CPYF	X		X	
CPYFRMDKT		X	X	
CPYFRMQRYF			X	
CPYFRMTAP		X	X	
CPYSRCF	X		X	
CPYTODKT	X			X
CPYTOTAP	X			X

1 FROMMBR is not a parameter on the CPYFRMQRYF command because the members to be queried are specified on the OPNQRYF command.

then all the members/labels are copied to a single spooled file, with the records for each member/label starting on a new page.

A single member or label or multiple members or labels can be copied to corresponding like-named to-file members or labels by specifying TOMBR(*FROMMBR), TOLABEL(*FROMMBR), or TOMBR(*FROMLABEL) depending on the copy command used. If the to-file is tape, this cannot be specified unless you are copying from a single from-file member or label. *FROMMBR is the default value for the TOMBR parameter on the CPYSRCF command, which causes the from-file members to be copied to like-named to-file members.

If the from-file is diskette or tape, the from-file label is used as the label for a diskette or tape to-file. If the to-file is a database file, the non-blank characters to the extreme right of the from-file label are used for the to-file member name, up to a maximum of either 10 characters or to the period at the extreme right in the from-file label. The copy operation ensures that only a valid member name is used for a database to-file, but does not ensure that a to-file label is valid for tape or diskette, so a label identifier that is nonstandard or not valid may be used for the to-file.

If the from-file is a tape file that is not labeled, then a to-file member or label name is created that corresponds to the data file on the tape from-file in the form of CPYnnnnn, where nnnnn is the tape sequence number of the data file.

For a database from-file or to-file, if a MBR parameter is specified on an OVRDBF (Override Database File) command, then the override member name is used instead of the value specified on the copy command. If the TOFILE parameter is specified with no MBR parameter value on the OVRDBF command, then the first member (in creation order) in the database file is used instead of the member specified on the copy command. For a diskette or tape from-file or to-file, if a LABEL parameter is specified on an OVRDKTF or OVRTAPF command, respectively, the override label name is used instead of the label specified on the copy command.

If multiple members/labels are being copied to corresponding like-named to-file members/labels (that is, TOMBR(*FROMMBR), TOLABEL(*FROMMBR), or TOMBR(*FROMLABEL) was specified), then an override to a single to-file member/label is not allowed unless the from-file is also overridden to a single member/label.

If a tape or diskette label is specified in the FROMMBR or TOMBR parameter, it can have a maximum length of 10 characters. If the label contains special characters or more than 10 characters, it must be specified on one of the following commands:

- Create Tape File (CRTTAPF)
- Change Tape File (CHGTAPF)
- Override with Tape File (OVRTAPF)
- Create Diskette File (CRTDKTF)
- Change Diskette File (CHGDKTF)
- Override with Diskette File (OVRDKTF)

Adding Members to the To-File

The copy function adds a member to the to-file when the member does not exist. The member name used is either the TOMBR parameter value from the copy command, or the member name specified in an override for the to-file.

If TOMBR(*FROMMBR) or TOMBR(*FROMLABEL) is specified on the copy command (and is not overridden), the from-file member names or label identifiers are used for the members added to the file.

If TOMBR(*FIRST) is specified on the copy command, or if there is an override that specifies a TOFILE parameter with no MBR parameter, then no member name is known. The copy function does not add a member in this case unless CRTFILE(*YES) was specified on the copy command and the copy function must create the to-file.

Except for the CPYFRMQRYF command, when the copy function creates the to-file without a specific member name specified, the from-file name is used for the member that is added to the to-file. When using the CPYFRMQRYF command, the member added to the physical file created by the copy operation has the name specified by the TOMBR parameter. If TOMBR(*FIRST) is specified, the to-file member has the same name as the to-file file name specified on the CPYFRMQRYF command TOFILE parameter. The MBROPT parameter value is ignored when the to-file is created, and records are added to the new file members.

If the from-file is a database file, the member text and SEU source type of the from-file member are used for the member added to the to-file. If the from-file is a device or inline data file, the text is taken from message CPX0411, and the SEU source type is TXT. If both the from-file and to-file are database source files, the SEU source type information in the added member will be the same as the from-file member. The SHARE(*NO) and EXPDATE(*NONE) attributes are always assigned to the to-file member when it is added by the copy operation. The creation date of the new member is also set to the current system date (not the date when the from-file member was added).

Selecting Records to Copy

You can select records to be copied based on the following (parameters given in parentheses):

- Record format name when a multiformat logical file is copied (RCDFMT)
- Relative record numbers (FROMRCD and TORCD)
- Record key values (FROMKEY and TOKEY)
- Number of records (NBRRCDS)
- One or more character values starting in a specified position in the record or a field (INCCHAR)
- Field value in a record (INCREL)
- Deleted records (COMPRESS)

The copy command parameters for record selection (FROMRCD, TORCD, FROMKEY, TOKEY, INCCHAR, and INCREL) are not on the CPYFRMQRYF command because record selection is provided on the OPNQRYF command.

See the *Database Guide* for details on record selection using open query file. For a detailed description of all considerations for each parameter, see the *CL Reference* manual.

Selecting Records Using a Specified Record Format Name (RCDFMT Parameter)

(CPYF command)

When you copy from a logical file to a physical file and the logical file has more than one record format, you must specify a record format name unless you specify FMTOPT(*NOCHK). If FMTOPT(*NOCHK) is used, then RCDFMT(*ALL) can be specified to copy all from-file record formats to the to-file. This record format name is used to select records to be copied.

In the following example, records are copied from the logical file ORDFILL to the physical file INVOICE using the record format ORDHDR:

```
CPYF   FROMFILE(DSTPRODLB/ORDFILL) +
  TOFILE(DSTPRODLB/INVOICE) RCDFMT(ORDHDR) +
  MBROPT(*ADD)
```

See "Copying between Different Database Record Formats (FMTOPT Parameter)" on page 4-25 for information about what happens when the from-file and to-file are both database files and their record formats are different.

When you copy from a logical file that has more than one record format to a device file, you can specify either a single record format to be used or specify RCDFMT(*ALL) to copy using all the record formats. If the record formats have different lengths, the shorter records are padded with blanks.

Selecting Records Using Relative Record Numbers (FROMRCD and TORCD Parameters)

(CPYF command)

Relative record numbers can be specified for a copy from any file type except a keyed logical file (a keyed physical file can be copied in arrival order if relative record numbers are specified for the FROMRCD or TORCD parameter). Records can be copied from a specified record number (FROMRCD parameter) to a specified record number (TORCD parameter) or until a specified number of records (NBRRCDS parameter) has been copied (see “Selecting a Specified Number of Records (NBRRCDS Parameter)” on page 4-20). If the end of the file is reached before the specified ending record number or number of records is reached, the copy completes normally.

When a relative record number is specified, records are copied, starting with the specified relative record number, in the order in which they physically exist in the database file being copied from. This is true even if the physical file has a keyed sequence access path. You can use the COMPRESS parameter with the FROMRCD and TORCD parameters to further define which records are to be selected for copying (see “Copying Deleted Records (COMPRESS Parameter)” on page 4-23).

If the from-file is a physical file or a logical file with an arrival sequence access path, the TORCD value is a relative record number that counts both the deleted and undeleted records ahead of it. If the from-file is a device file or inline data file, the TORCD value is a record number that includes only undeleted records (even for an I-format diskette file).

Deleted records retain their position among records that are not deleted, but not necessarily their relative record number when they are copied if they are in the specified subset and COMPRESS(*NO) is specified. If COMPRESS(*YES) is specified, the deleted records are skipped and are not copied. In this case, when the record number specified (FROMRCD parameter) is a deleted record, copying starts with the first undeleted record that follows.

In the following example, the records from relative record number 500 to relative record number 1000 in the file EMP1 are copied to the file EMP1T.

```
CPYF    FROMFILE(PERSONNEL/EMP1) +
  TOFILE(TESTLIB1/EMP1T) MBROPT(*REPLACE) +
  FROMRCD(500) TORCD(1000)
```

Note: If you use record numbers to select records, you cannot use record keys (FROMKEY/TOKEY parameters) to select records on the same CPYF command.

Selecting Records Using Record Keys (FROMKEY and TOKEY Parameters)

(CPYF command)

Record keys can only be specified to copy from a keyed database file. Records can be copied from a specified key value (FROMKEY parameter) to a specified key value (TOKEY parameter) or until a specified number of records (NBRRCDS parameter) is reached (see “Selecting a Specified Number of Records (NBRRCDS Parameter)” on page 4-20). If the end of the file is reached before the specified ending key value or number of records is reached, the copy completes normally.

If no record in the from-file member has a key that is a match with the FROMKEY value, but there is at least one record with a key greater than the specified value, the first record copied is the first record with a key greater than the FROMKEY value. If the specified key value is greater than any record in the member, an error message is sent and the member is not copied.

You can specify *BLDKEY on the FROMKEY and TOKEY parameters to use a list of character and numeric values in their natural display form for the fields in a key. Each element is converted to the corresponding key field data type. The **composite key** value (a key comprised of more than one field) is provided to the database.

If you specify fewer values than the complete database key contains, a partial key is built and passed to the database. If you specify more values than the database key contains, an ending error occurs. The values are always applied to the consecutive fields to the extreme left in the key so that it is impossible to skip key fields.

Character fields are padded on the right with blanks. Numeric fields are adjusted to the implied decimal point in the key field with the correct zero padding.

All regular rules for specifying numeric fields in an external character format apply. Note that the floating-point value of *NAN (Not a Number) is not allowed.

The check made by the copy operation (when the TOKEY value is specified) is a logical character comparison between the key string for each record retrieved and the key string that is specified explicitly (using the first TOKEY parameter format) or built implicitly by the copy operation (using the list of values given for a *BLDKEY specification). A warning message is sent (but the copy operation continues) if this comparison gives different results than the ordering in which the database identifies the records in the keyed access path. The order may be different if the key contains
| mixed ascending and descending fields, if the key
| contains fields for which a sort sequence other
| than *HEX is in effect, or if the key contains any of the following DDS keywords:

ABSVAL	Absolute value
ALTSEQ	Alternative collating sequence
ALWNULL	Allow null
| DATFMT	Date format (*MDY, *DMY, *YMD,
|	*JUL, SAA *EUR, or SAA *USA)
DIGIT	Digit force
SIGNED	Signed numeric
TIMFMT	Time format (*USA)
ZONE	Zone force

If there are both ascending and descending fields in the file key, the first (the far left) key field determines whether the copy operation uses an ascending or descending key test to look for the last record to copy.

Using *BLDKEY is the easiest way to specify (and ensure correct padding) values for packed, binary, and floating-point fields.

An example of the build-key function is:

Key Field Number	Type	Length	Decimal Precision	Value
1	CHAR	6		KEN
2	ZONED	6	2	54.25
3	BINARY	4	1	10.1

You could specify the FROMKEY (or TOKEY) parameter as follows:

```
FROMKEY( 2  x'D2C5D5404040F0F0F5F4F2F50065')
```

or, you could use the *BLDKEY value and specify the FROMKEY as follows:

```
FROMKEY(*BLDKEY    (KEN 54.25 10.1))
```

Another example using key fields 1 and 2 is:

```
FROMKEY(2  'KEN    005425')
```

or, the *BLDKEY value can be specified:

```
FROMKEY(*BLDKEY    (KEN 54.25))
```

In the following example, the records in the file EMP1 are copied to the file EMP1T. EMP1T is a file in a test library. Because you only need a subset of the records, you specify a from-key value and a to-key value. Both are full key values. Note that a 1 specified in the FROMKEY and TOKEY parameters indicates the number of key fields to be used in searching the record keys, starting with the first key field.

```
CPYF   FROMFILE(PERSONNEL/EMP1) +
  TOFILE(TESTLIB1/EMP1T) MBROPT(*REPLACE) +
  FROMKEY(1 438872) TOKEY(1 810199)
```

All positions in a key value should be specified, because if the value is shorter than the key field length, it will be padded on the right with zeros. Thus, a 5-position key field specified as FROMKEY(1 8) causes a search for a key equal to hex F800000000. If the key value contains blanks or special characters, it must be enclosed in apostrophes.

Note: If you use record keys to select records, you cannot use relative record numbers (FROMRCD/TORCD parameters) to select records on the same CPYF command.

You should not specify COMPRESS(*NO) when selecting records by record key from a keyed physical file. Because deleted records are not contained in the keyed access path of a file, they are never copied, so the compression is automatic.

Because deleted records are canceled in a copy by this method, it is also possible that the relative record numbers have changed in the new file, even if you have specified MBROPT(*REPLACE).

Specifying Data for Different Field Types and Attributes

Variable-Length Fields: When the number of key fields and a value are used to specify the FROMKEY or TOKEY parameter, the string should include the 2-byte length field for each variable-length key field. The variable-length key field must be padded with blanks so that keys following the variable-length key field are in the correct position. The data can be specified in hexadecimal format.

When *BLDKEY is specified on the FROMKEY or TOKEY parameter for variable-length key fields, specify the character string without the 2-byte length field. Only the amount of data entered for the key value is used for key comparisons. A zero-length string can be specified for variable-length key fields.

Date, Time, and Timestamp Fields: When the number of key fields and a value are used to specify the FROMKEY or TOKEY parameter, no conversion of data occurs if the corresponding key field in the from-file is a date, time, or timestamp field. The user input string specified must be in the same format as the date, time, or timestamp field (including separators). If it is not, a file open error may occur, or the records copied may not be the desired result.

If *BLDKEY is specified for the FROMKEY or TOKEY parameter and the corresponding key field in the from-file is a date, time, or timestamp field, the system attempts to convert the user-input key field value to the format (and separators) of the from-file field. The following rules apply to the conversion:

- **If the from-field is a date key field,** the system first determines if the user-input key value is in the same format and has the same separator as specified in the current job under which the copy command is running. This can be *MDY, *DMY, *YMD, or *JUL for the format and slash (/), hyphen (-), period (.), comma (,), or blank ( ) for the separator. If the user-input key value is not in the current job specified format and separator form, it determines if it is in one of the Systems Application Architecture* (SAA*) formats (*ISO, *USA, *EUR, or *JIS). It also determines if it is in a YYYYDDD form (no separator). If the system can determine the user-input key value is in one of these forms, the input string is converted to the actual format (and separator) of the from-file date field, which is used for the key comparison. If the user-input string format cannot be determined or the length or data value is not valid, a diagnostic message is issued. The date portion of the user-input key value must be left justified and can contain trailing blanks.
- **If the from-field is a time key field,** the system first determines if the user-input key value is in the same format and has the same separator as specified in the current job under which the copy command is running. This may be HHMMSS for the format and colon (:), comma (,), period (.), or blank ( ) for the separator. If the user-input key value is not in the current job specified format and separator form, the system determines if it is in one of the SAA formats (*ISO, *USA, *EUR, or *JIS). If the system can determine the user-input key value is in one of these forms, the input string is converted to the actual format (and separator) of the from-file time field, which is used for the key comparison. If the user-input string format cannot be determined, or the length or data value is not valid, a diagnostic message is issued. The time portion of the user-input key value must be left justified and can contain trailing blanks.
- **If the from-field is a timestamp key field,** the system first determines if the user-input key value is in the SAA format or YYYYMMDDHHMMSS form. If the system determines the user-input key value is in one of these forms, the input string is converted to the actual SAA timestamp format, which is used for the key comparison. If the user-input string format cannot be determined, or the length or data value is not valid, a diagnostic message is issued. The timestamp portion of the user-input key value must be left justified and can contain trailing blanks.

Null-Capable Fields: When the number of key fields and a value are used to specify the FROMKEY or TOKEY parameter, the null values are ignored. Only the buffer default value for values that are actually null are used for the comparison.

When *BLDKEY is specified on the FROMKEY or TOKEY parameter, none of the *BLDKEY values can reference a null-capable field. If it does, an error message is sent.

CCSIDs: When the number of key fields and a value are used to specify the FROMKEY or TOKEY parameter, no CCSID conversions are done on the input string.

When *BLDKEY is specified on the FROMKEY or TOKEY for character, DBCS-open, DBCS-either, or DBCS-only fields, the value specified is assumed to be in the CCSID of the process in which the copy command is running. Each of these key values is converted from the job CCSID to the CCSID of the from-file key field. If no conversion table is defined or an error occurs while converting the input key value, a message is sent and the copy operation ends. If the value can be correctly converted, the converted value is used to build the key value that determines the first and last record to be copied.

DBCS-Graphic Fields: When the number of key fields and a value are used to specify the FROMKEY or TOKEY parameter, no conversions are done on the input string; the input string is used as is.

When *BLDKEY is specified on the FROMKEY or TOKEY for DBCS-graphic fields, the DBCS data should be enclosed in shift-out and shift-in characters. The DBCS data is assumed to be in the associated DBCS CCSID of the job CCSID. The shift-out and shift-in characters are removed before building the key. If the input string is not enclosed in shift-out and shift-in (SO-SI) characters or the data cannot be converted to the DBCS CCSID of the from-file key field, a message is sent and the copy operation ends.

Selecting a Specified Number of Records (NBRRCDS Parameter)

(CPYF, CPYFRMDKT, CPYFRMQRYF, CPYFRMTAP, CPYTODKT, and CPYTOTAP commands)

When you specify a FROMKEY or FROMRCD parameter, you can specify the number of records (NBRRCDS parameter) to be copied instead of the TOKEY or TORCD parameter (you cannot specify both the NBRRCDS and the TORCD or TOKEY parameters). The specified number of records is copied starting with the specified from-key value or from-record number.

You can specify the NBRRCDS parameter without specifying the FROMKEY or FROMRCD parameter. Records are copied starting with the first record in the file. Note that the number of records specified is the number of records actually copied to the to-file, which includes deleted records in the from-file if COMPRESS(*NO) is specified, and does not include records excluded by the INCCHAR and INCREL parameters.

In the following example, 1000 records in the file EMP1 are copied to the file EMP1T. Records are copied from the first member in EMP1 and replace the records in the first member in EMP1T.

```
CPYF   FROMFILE(PERSONNEL/EMP1) +
  TOFILE(TESTLIB1/EMP1T) MBROPT(*REPLACE) +
  NBRRCDS(1000)
```

You can also use the NBRRCDS parameter to examine a subset of records on a list:

```
CPYF   FROMFILE(PERSONNEL/EMP1) TOFILE(*PRINT) +
  FROMRCD(250) NBRRCDS(10) OUTFMT(*HEX)
```

In the case of a successful copy of an open query file, the file position is unpredictable. If you want to run a different program with the same files or run another CPYFRMQRYF, you must position the file or close the file and open it with the same OPNQRYF command. You may position the file with the Position Database File (POSDBF) command. In some cases, a high-level language program statement can be used.

Selecting Records Based on Character Content (INCCHAR Parameter)

(CPYF command)

Records can be selected based on the content of specified characters starting in a specified position in the record or field. The INCCHAR parameter can be used with the FROMKEY or FROMRCD parameter, to select records first by their key value or relative record number and then by characters in some position in the record or field.

You can test for any character string of 1 through 256 bytes. If the character string contains any special characters or blanks, the whole string must be enclosed in apostrophes.

You can also specify *CT (contains) as the operator for the INCCHAR parameter. This specifies that each record in the from-file is to be scanned for the selection character string. You can specify any valid starting position in the field or record for the start of the scan, and the data will be scanned from that position to the byte to the extreme right of the field or record.

If you specify both the INCCHAR and INCREL parameters, a record is copied only if it satisfies both the INCCHAR and INCREL conditions.

The following example tests for all records in the file DBIN that have an XXX starting in position 80, and copies them to the file DKTOUT. Because this example includes testing for positions relative to the length of the whole record, *RCD must be specified on the INCCHAR parameter.

```
CPYF FROMFILE(DBIN) TOFILE(DKTOUT) +
  INCCHAR(*RCD 80 *EQ XXX)
```

If you were testing for an XXX in a position in a particular field in the record, you would specify the field name instead of *RCD, and the starting position of the character relative to the start of the field.

```
CPYF FROMFILE(DBIN) TOFILE(DKTOUT) +
  INCCHAR(FLDA 6 *EQ XXX)
```

A field name cannot be specified if RCDFMT(*ALL) is specified when copying from a multiple-format logical file, or if the from-file is a device file or inline data file.

Specifying Data for Different Field Types and Attributes

Variable-Length Fields: When *RCD is specified for the INCCHAR parameter, the starting position represents the position in the buffer. The 2-byte length field of variable-length fields must be considered when determining the position. Use single-byte blanks (X'40') to pad variable-length fields if the INCCHAR value spans multiple fields.

Variable-length fields can be specified for the INCCHAR string when a field name is specified. The starting position represents the position in the data portion of the variable-length from-field value. The number of bytes compared is the number of bytes in the value specified for the INCCHAR string. If the actual data in the variable-length from-field is shorter than the value specified for the INCCHAR parameter, the from-field data is padded with single-byte blanks (X'40') for the comparison.

A zero-length string cannot be specified for the INCCHAR value.

Null-Capable Fields: The INCCHAR parameter allows null-capable character-field and null-capable DBCS-field names to be specified; however, any logical comparison with a null-field value tests as false, and the record is not copied. No special processing is done if the *RCD special value is entered as the field name. Only buffer default values for actual null values are compared.

CCSIDs: When *RCD is specified for the INCCHAR parameter, no conversion is done on the input string. The byte string entered is compared at the specified position in the record buffer of the from-file.

When a field name is specified, the input string is assumed to be in the CCSID of the job in which the copy command runs. The input string is converted to the CCSID of the from-field. If no translation table is defined or if an error occurs while converting the input string, a message is sent and the copy operation ends. If the value can be correctly converted, the converted value is used for record selection.

DBCS-Graphic Fields: When a graphic field is specified for the INCCHAR parameter, the DBCS data should be enclosed in shift-out and shift-in characters. The data is assumed to be in the associated DBCS CCSID of the job CCSID. There must be a valid conversion to the field CCSID or an error occurs. The shift-out and shift-in characters are removed before doing the comparison. The position specifies the DBCS character position in which to begin the comparison.

Selecting Records Based on Field Value (INCREL Parameter)

(CPYF command)

The INCREL parameter is used to select records for copying by testing for the value of an entire field. Unlike the INCCHAR parameter, you can use the INCREL parameter only when copying from a database file, and you can test for different values in different fields on one copy command.

You can use as many as 50 AND and OR relationships on one INCREL parameter. The OR relationship is used to group the AND relationships. For example, the following INCREL parameter essentially says this: If field FLDA is greater than 5 and field FLDB is less than 6, select the record, or if FLDB is equal to 9 (FLDA is any value), select the record.

```
INCREL((*IF FLDA *GT 5) (*AND FLDB *LT 6) +
  (*OR FLDB *EQ 9))
```

The value you specify must be compatible with the field type. Each INCREL relational set must be enclosed in parentheses.

The value *IF must be specified as the first value in the first set of comparison values, if there is only one set or several sets of comparison values. If more than one set of comparison values are specified, either *AND or *OR must be specified as the first value in each set after the first set of values.

In the following discussion, an IF group refers to an IF set, optionally followed by one or more AND sets. An OR group refers to an OR set, optionally followed by one or more AND sets. All the comparisons specified in each group are done until a complete group, which is a single IF set or OR set having no AND sets following it, yields all true results. If at least one group has a true result, the record is included in the copied file.

The first set of comparison values (*IF field-name operator value) and any AND sets logically connected with the IF set are evaluated first. If the results in all of the sets in the IF group are true, the testing ends and the record is copied. If any of the results in the IF group are false and an OR group follows, another comparison begins. The OR set and any AND sets that follow it are evaluated (up to the next OR set). If the results in the OR group are all true, the record is included. If any result is false and another OR group follows, the process continues until either an OR group is all true or until there are no more OR groups. If the results are not all true for any of the IF or OR groups, the record is excluded (not copied to the to-file).

If you specify both the INCCHAR and INCREL parameters, a record is copied only if it satisfies both the INCCHAR and INCREL conditions.

The INCREL parameter cannot be specified if RCDFMT(*ALL) is specified when copying from a multiple-format logical file.

Specifying Data for Different Field Types and Attributes

Variable-Length Fields: Variable-length character fields are allowed for the INCREL parameter. Enter the character value without the 2-byte length field. The length of the data entered determines the number of bytes used for the comparison. If the actual data in the variable-length from-field is shorter than the value specified for the INCREL parameter, the from-field data is padded with single-byte blanks (X'40') for the comparison.

Date, Time, and Timestamp Fields: The INCREL parameter allows date, time, and timestamp fields. The input field value is compared chronologically to the value in the date, time, or timestamp field to determine if the record should be selected. The system attempts to convert the input string and the actual field value to an internal form that is chronologically compared. These rules apply to the conversion:

- **If the from-field is a date field,** the system determines if the user-input field value is in the same format and has the same separator as specified in the current job under which the copy command is running. The format could be *MDY, *DMY, *YMD, or *JUL and could use a slash (/), hyphen (-), period (.), comma (,), or blank ( ) for the separator. If the user-input field value does not use the same format or separator form of the current job, the system determines if it is one of the SAA formats (*ISO, *USA, *EUR, OR *JIS) or if it is a YYYYDDD form with no separators. If the system determines the user-input field value is one of these forms, the input string is converted to an internal form. The from-field is then converted to its internal form, and the comparison is made. If the user-input string format cannot be determined, or the length or data value is not valid, a diagnostic message is issued and the copy operation ends. The date portion of the user-input field value must be left justified and can contain trailing blanks.

- **If the from-field is a time field,** the system determines if the user-input field value is in the same format and has the same separator as specified in the current job under which the copy command is running. The format could be HHMMSS and have a colon (:), comma (,), period (.), or blank ( ) for the separator. If the user-input field value is not in the specified format and separator form of the current job, the system determines if it is in one of the SAA formats (*ISO, *USA, *EUR, or *JIS). If the system determines the user-input key value is in one of these forms, the input string is converted to an internal form. The from-field is then converted to its internal form, and the chronological comparison is made. If the user-input string format cannot be determined or the length or data value is not valid, a diagnostic message is issued and the copy operation ends. The time portion of the user-input field value must be left justified and it can contain trailing blanks.
- **If the from-field is a timestamp field,** the system first determines if the user-input field value is in the SAA format or YYYYMMDDHHMMSS form (no separators). If the system determines the user-input field value is in one of these forms, the input string is converted to an internal form. The from-field is then converted to its internal form and the chronological comparison is made. If the user input string format cannot be determined, or the length or data value is not valid, a diagnostic message is issued and the copy operation ends. The timestamp portion of the user-input field value must be left justified and can contain trailing blanks.

Null-Capable Fields: The INCREL parameter allows a value of *NULL as input for a field value. The *EQ and *NE operators can be used with the *NULL value to test whether a field in a database file contains the null value or not. *EQ means the value is null and *NE means the value is not null when the *NULL value is specified. The *NULL value is not limited to null-capable fields.

CCSIDs: The input string for character, DBCS-open, DBCS-either, or DBCS-only fields is assumed to be in the CCSID of the job in which the copy command is running. The input string is converted to the CCSID of the from-field. If no conversion table is defined or an error occurs while converting the input string, a message is sent and the copy operation ends. If the value can be correctly converted, the converted value is used for record selection.

DBCS-Graphic Fields: When a graphic field is specified for the INCREL parameter, the DBCS data should be enclosed in shift-out and shift-in characters. The data is assumed to be in the associated DBCS CCSID of the job CCSID. There must be a valid conversion to the field CCSID or an error occurs. The shift-out and shift-in characters are removed before doing the comparison.

Copying Deleted Records (COMPRESS Parameter)

(CPYF command)

You can copy deleted and undeleted records from one physical file member to another by specifying COMPRESS(*NO) on a copy command. You may want to copy deleted records to preserve the relative record numbers of records copied from the from-file. If COMPRESS(*NO) is not used, only records that are not deleted are copied from the from-file.

To use COMPRESS(*NO), the from-file and to-file must both be physical files, they must both be the same type (either source or data), and they must either have identical record formats or

FMTOPT(*NOCHK) must be specified to perform the copy. COMPRESS(*NO) also requires that you use all the following (default) parameter values on the copy command:

PRINT(*NONE)
INCCHAR(*NONE)
INCREL(*NONE)
SRCOPT(*SAME)
ERRLVL(0)

COMPRESS(*NO) is not allowed for certain types of access paths over the to-file, including when the access path is contained in a logical file and is based on the to-file member. The following types of access paths over a to-file member do not allow COMPRESS(*NO) to be specified:

- Unique keys (UNIQUE keyword specified in the DDS for the file).
- Select/omit specifications without the DYNSLT keyword (in the DDS for the file), and immediate or delayed maintenance (MAINT(*IMMED) or MAINT(*DLY) specified on the CRTPF or CRTLF command).
- Floating-point key field or logical numeric key field (in the DDS for the file), and immediate or delayed maintenance (MAINT(*IMMED) or MAINT(*DLY) specified on the CRTPF or CRTLF command). Note that a logical numeric key field is one of the following:
  - A numeric key field in a logical file.
  - A field specified as a *to* field on the JFLD keyword that has different attributes than in the based-on physical file.
  - A field specified as a sequencing field on the JDUPSEQ keyword that has different attributes than in the based-on physical file.

You cannot specify COMPRESS(*NO) for any of the following cases:

- If the to-file is being journaled (JRNPF command).
- If the to-file member is in use, or if any access path over the to-file member is in use.
- If an EOFDLY wait time is specified for the from-file on an OVRDBF command.

COMPRESS(*NO) may allow the system to perform the copy more quickly because records are transferred in blocks, but this is *not always* true. Usually, the COMPRESS(*NO) function does not significantly affect performance. One of the factors you should consider before you specify COMPRESS(*NO) is that the internal system function that must be used to perform this type of copy invalidates any keyed access paths that use the to-file member before the records are copied, and then rebuilds the access paths after the copy is complete. The run time and resource required to rebuild the keyed access paths may be larger than the performance benefit gained by copying deleted records.

If COMPRESS(*NO) is *not* specified, the system may still use the internal functions to perform the copy, but the choice of how the copy is performed is based on the number of records in the from-file and to-file members before the copy, and the number of keyed access paths over the to-file member.

If MBROPT(*REPLACE) is specified, all keyed access paths over the to-file member must be invalidated and rebuilt, so specifying COMPRESS(*NO) does not cause any additional overhead for rebuilding access paths.

If the from-file is a keyed physical file and neither a FROMRCD nor TORCD relative record number value is specified on the copy commands to force the file to be processed in arrival sequence, COMPRESS(*NO) has no meaning because a keyed access path never contains any deleted records.

Printing Records (PRINT, OUTFMT, and TOFILE(*PRINT) Parameters)

(CPYF, CPYFRMDKT, CPYFRMQRYF, and CPYFRMTAP commands)

You can print a list of all records copied or all records excluded or both. Records can be printed in character format or in character and hexadecimal format. The records are printed using the IBM-supplied printer file QSYSPRT. You can specify TOFILE(*PRINT) to print these records to a printed listing.

You can specify *EXCLD on the PRINT parameter to print only excluded records or *COPIED to print only copied records. Records are copied or excluded based on the specifications on the

INCCHAR or INCREL parameter. If both are specified all the excluded records are in one list, and all the copied records are in another. If multiple members are being copied, a list is produced for each member/label. Excluded records are printed in the from-file record format, and copied records are printed in the to-file record format.

The OUTFMT parameter defaults to *CHAR; records are printed in character format. If you specify *HEX, records are printed in both character and hexadecimal format.

If you specify TOFILE(*PRINT), the OUTFMT parameter again specifies the format that is used to print the records (see “Basic Copy Function” on page 4-5).

In the following example, all records that are not copied are printed:

```
CPYF    FROMFILE(DKTIN) TOFILE(LIB1/PF) +
  MBROPT(*ADD) INCCHAR(*RCD 80 *EQ X) +
  PRINT(*EXCLD)
```

The records are printed in character format.

CCSIDs: When PRINT(*EXCLD) is specified, the records are printed in the from-file format. All character data is in the CCSID specified in the from-file field.

For TOFILE(*PRINT) and PRINT(*COPIED) listings and when the to-file is a print file, character data is in the CCSID specified in the to-file fields.

Creating an Unformatted Print Listing

If an unformatted print listing is wanted, or if the from-file records should be formatted using first-character forms control (CTLCHAR(*FCFC) specified on the Create Printer File (CRTPRTF), Change Printer File (CHGPRTF), or Override Printer File (OVRPRTF) command), a program-described printer device file name (which can be QSYSPRT or user-defined) must be specified instead of *PRINT. For copy commands where TOFILE(*PRINT) is specified with a PRINT parameter value of either *COPIED or *EXCLD (or both), the QSYSPRT file must be spooled [SPOOL(*YES)] and must be specified in the device file or on the OVRPRTF command, because separate print files are opened for each file requested. All the records are copied to a single spooled file, and the data for each member or label identifier copied begins on a new print page.

Copying between Different Database Record Formats (FMTOPT Parameter)

(CPYF and CPYFRMQRYF commands)

When you copy from a database file to a database file, you must use the FMTOPT parameter if the record formats are not identical or if the files are different types (source or data). If either file is a device file or inline data file, the FMTOPT parameter does not apply. The records are truncated or padded with blanks or zeros when record lengths are different. A message is sent if the records are truncated.

For database files, when either FMTOPT(*CVTSRC) or FMTOPT(*NOCHK) is specified and the record data copied from any from-file record is not long enough to fill a to-file record, the extra bytes in the to-file record are set to a default value. If a default value other than *NULL is specified in the DDS (DFT keyword) for a field, that field is initialized to the specified default; otherwise, all numeric fields are initialized to zeros, all character fields are initialized to blanks, all date, time, and timestamp fields are initialized to the current system date and time. If *NULL is specified on the DFT keyword, only the default buffer value is used. A *NULL default is ignored.

If the from-file or to-file is a device file or an inline data file, copy automatically adds or deletes the source sequence number and date fields for each record copied.

If one file is a data file and the other a source file, you must specify FMTOPT(*CVTSRC) to perform the copy. The sequence number and date fields are added or deleted as appropriate and the data part of each record is copied without regard to the other field definitions in the file record formats. The SRCSEQ parameter can be used to control how the sequence numbers are created, provided SRCOPT(*SEQNBR) is also specified.

For database-to-database copies, you can reconcile any differences in record formats by specifying:

- *DROP to drop those fields in the from-file record format for which there are no fields of the same name in the to-file record format.
- *MAP to convert fields in the from-file to the attributes of like-named fields in the to-file and to fill extra fields in the to-file, that are not in the from-file, with their default values. The default values are:
  - The parameter value (including *NULL) for the DFT keyword, if specified for the field
  - Blanks (for character fields without the DFT keyword)
  - Zeros (for numeric fields without the DFT keyword)
  - Current date, time, or timestamp for those type fields without the DFT keyword

  *MAP is required if fields with the same name are in different positions in the file record formats, even though these fields have the same attributes.
- *DROP and *MAP to drop fields in the from-file not named in the to-file and to convert remaining fields through mapping rules to fit the to-file fields that have different attributes or positions.
- *NOCHK to disregard the differences. Data is copied left to right directly from one file to the other. Null values are ignored. The copied records are either truncated or padded with default buffer values. Because no checking is done, fields in the to-file may contain data that is not valid for the field as defined.

Dropping and mapping fields are based on a comparison of field names. Unless all the fields in the from-file have the same name in the to-file, you must specify *DROP. If the names are the same, but the attributes or position in the record is different, you must specify *MAP. Dropped fields are not copied. There must be at least one like-named field in both record formats to do mapping.

When *MAP is specified, fields in the to-file record format that do not exist in the from-file record format are filled with their default values, as described earlier in this section. For fields that have the same name and attributes, the field in the from-file record format is mapped to the field with the same name in the to-file record format, even if their positions in the formats are different.

For example, the field CUSNO is the first field in the record format ORDHD, but it is the second field in record format ORDHD1. When the CUSNO field is copied with *MAP, it is mapped to the second field of ORDHD1.

Table 4-5 on page 4-27 summarizes the database-to-database copy operations for each value on the FMTOPT parameter.

Table 4-5. Database-to-Database Copy Operations

FMTOPT Parameter Values	**Database File Record Formats**				
	ALL Field Names in From-and To-Files Are the Same (like-named)		**SOME Field Names in From-and To-Files Are the Same**		**NO Field Names in Either File Are the Same**
	Attributes and relative order also the same (see note 1)	Attributes and relative order not the same (see note 1)	Like-named fields have identical attributes and relative order (see note 1)	Not all like-named fields have identical attributes and relative order (see note 1)	
*NONE	Complete copy	Command ends	Command ends	Command ends	Command ends
*DROP	Complete copy (value ignored)	Command ends	If there are extra fields in the from-file, they are dropped, all others are copied. If there are extra fields in the to-file, the command ends. If there are extra fields in the from-file and in the to-file, the command ends.	Command ends	Command ends
*MAP (see note 2)	Complete copy (value ignored)	Complete copy (corresponding fields are mapped)	If there are extra fields in the from-file, the command ends. If there are extra fields in the to-file, they are filled, and the like-named fields are mapped. If there are extra fields in the to-file and the from-file, the command ends.		Command ends
*MAP and *DROP (see note 2)	Complete copy (value ignored)	Complete copy (corresponding fields are mapped)	Extra fields in the from-file are dropped; like-named fields are mapped; extra fields in the to-file are filled.		Command ends
*NOCHK	Complete copy (value ignored)	Complete copy (direct data transfer disregarding fields) (see note 3)			

Notes:

1. Field attributes include the data type (character, zoned, packed, binary or floating point), field length, decimal position (for numeric fields), date or time format (for date or time fields), null capability, CCSID, and whether the field has variable length or fixed length.
2. Mapping consists of converting the data in a from-file field to the attributes of the corresponding (like-named) to-file field. If the attributes of any corresponding fields are such that the data cannot be converted, the copy is ended.
3. The records are padded or truncated as necessary. Data in the from-file may not match the to-file record format.

Specifying Data for Different Field Types and Attributes

Variable-Length Fields: FMTOPT(*MAP) can be used to map data between fixed- and variable-length fields and between variable-length fields with different maximum lengths.

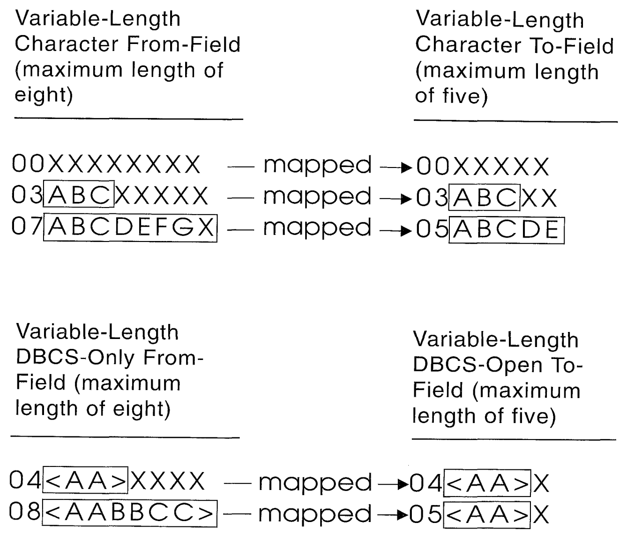
When mapping a variable-length field with a length of zero to a:

- variable-length to-field, the to-field length is set to zero.
- fixed-length to-field, the to-field is filled with single-byte blanks (X'40'), unless the to-field is a DBCS-only field. A DBCS-only to-field is set to X'4040's and surrounded by shift-out and shift-in (SO-SI) characters.

The following applies when the from-field does not have a length of zero and graphic fields are not being mapped to or from bracketed DBCS fields.

Mapping Variable-Length Fields to Variable-Length Fields: The length of a variable-length from-field is copied to a variable-length to-field when the from-field data length is less than or equal to the maximum length of the to-field. If the from-field data length is greater than the maximum length of the to-field, the data of the from-field is truncated to the maximum length of the to-field, and the to-field length is set to the maximum length. The data is truncated in a manner that ensures data integrity.

Note: In the examples, x represents a blank, < represents the shift-out character, and > represents the shift-in character. The 2-byte length is actually a binary number shown as a character to make the example readable.


Variable-Length Character From-Field (maximum length of eight)
Variable-Length Character To-Field (maximum length of five)
00XXXXXXXX — mapped → 00XXXXX
03ABCXXXXX — mapped → 03ABCXX
07ABCDEFGX — mapped → 05ABCDE
Variable-Length DBCS-Only From-Field (maximum length of eight)
Variable-Length DBCS-Open To-Field (maximum length of five)
04<AA>XXXX — mapped → 04<AA>X
08<AABBCC> — mapped → 05<AA>X

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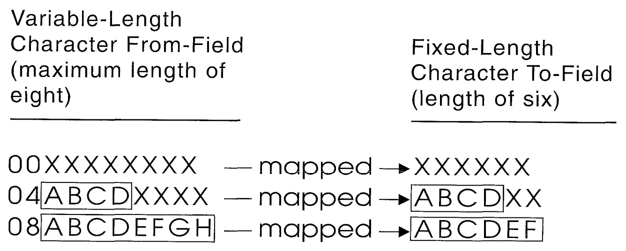
Mapping Variable-Length Fields to Fixed-Length Fields: If the data length of the from-field is less than or equal to the to-field length, the data is copied to the fixed-length to-field and padded to ensure data integrity.

If the length of the from-field data is greater than the to-field length, the from-field data is copied to the to-field and truncated on the right in a manner that ensures data integrity.


Variable-Length Character From-Field (maximum length of eight)
Fixed-Length Character To-Field (length of six)
00XXXXXXXX — mapped → XXXXXX
04ABCDXXXX — mapped → ABCDXX
08ABCDEFGH — mapped → ABCDEF

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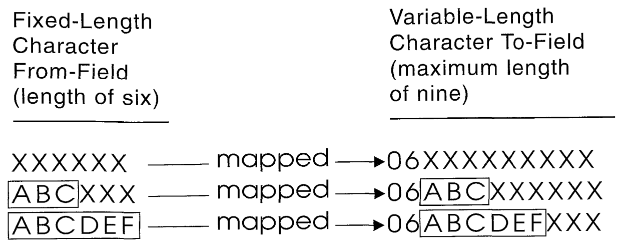
Mapping Fixed-Length Fields to Variable-Length Fields: If the to-field has a maximum length greater than or equal to the from-field length, the from-field data is copied to the data portion of the to-field and padded to the right with single-byte blanks. The to-field length is set to the length of the from-field length.


Fixed-Length Character From-Field (length of six)
Variable-Length Character To-Field (maximum length of nine)
XXXXXX mapped 06XXXXXXXXX
ABCXXX mapped 06ABCXXXXXX
ABCDEF mapped 06ABCDEFXXX
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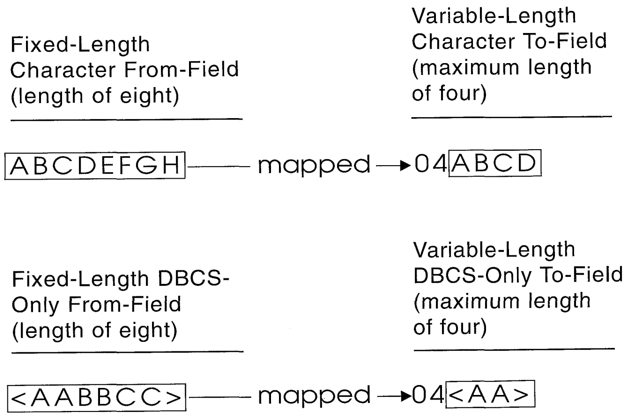
If the length of the from-field is greater than the maximum length of the variable-length to-field, the length portion of the variable-length to-field is set to the maximum length of the variable-length to-field. The data from the fixed-length from-field is copied to the data portion of the variable-length to-field and truncated on the right in a way that ensures data integrity.


Fixed-Length Character From-Field (length of eight)
Variable-Length Character To-Field (maximum length of four)
ABCDEFGH mapped 04ABCD
Fixed-Length DBCS-Only From-Field (length of eight)
Variable-Length DBCS-Only To-Field (maximum length of four)
<AABBCC> mapped 04<AA>
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Date, Time, and Timestamp Fields: FMTOPT(*MAP) or FMTOPT(*NOCHK) must be specified on the CPYF command if:

The from-file is a database data file.
The to-file is a physical data file.
The record formats are not identical.

Corresponding date, time, and timestamp fields in the from-file and to-file must have the same format attribute and separator for the record formats to be identical. For the CPYFRMQRYF command, the same is true except that the open query file record format is used (rather than a from-file format).

When using FMTOPT(*NOCHK), record data is copied directly from left to right into the to-file without any regard to field types.

When using FMTOPT(*CVTSRC), data portions of records are directly copied from left to right into the to-file without any regard to the field types.

When using FMTOPT(*DROP), fields in the from-file but not in the to-file are dropped. If any like-named fields in the from-file and to-file are date, time, or timestamp fields, the corresponding field must be the same type, have the same format attribute and separator, and have the same relative position in the record format as the like-named field, otherwise FMTOPT(*MAP) may also be required.

FMTOPT(*MAP) allows copying between like date, time, and timestamp field types regardless of the format or separator. Also, copies from and to date, time, and timestamp fields are allowed from and to zoned-decimal or character field types, provided the lengths, formats, and values can be converted. FMTOPT(*MAP) is required in this case for conversion to the to-field type (format and separator, if it applies).

Table 4-6 on page 4-30 outlines the conversion possibilities for the date, time, and timestamp.

Table 4-6. Conversion Table

Data types	**Forms**	**Allowable Field Length**	**Direction**	**Data Type**	**Formats**	**Allowable Field Length**
Date	Any date format	6, 8, or 10	<-->	Date	Any	6, 8, or 10
Zoned	(MMDDYY)	6,0	<-->	Date	Any	6, 8, or 10
Zoned	(DDMMYY)	6,0	<-->	Date	Any	6, 8, or 10
Zoned	(YYMMDD)	6,0	<-->	Date	Any	6, 8, or 10
Zoned	(YYDDD)	5,0	<-->	Date	Any	6, 8, or 10
Character	(MMdDDdYY)	6 min	<-->	Date	Any	6, 8, or 10
Character	(DDdMMdYY)	6 min	<-->	Date	Any	6, 8, or 10
Character	(YYdMMdDD)	6 min	<-->	Date	Any	6, 8, or 10
Character	(YYdDDD)	6 min	<-->	Date	Any	6, 8, or 10
Character	(*USA)	6 min	---->	Date	Any	6, 8, or 10
Character	(*ISO)	6 min	---->	Date	Any	6, 8, or 10
Character	(*EUR)	6 min	---->	Date	Any	6, 8, or 10
Character	(*JIS)	6 min	---->	Date	Any	6, 8, or 10
Character	(YYYYDDD)	6 min	---->	Date	Any	6, 8, or 10
Time	Any time format	8	<-->	Time	Any	8
Zoned	(HHMMSS)	6,0	<-->	Time	Any	8
Character	(HHtMMtSS)	4 min	---->	Time	Any	8
Character	(*USA)	4 min	---->	Time	Any	8
Character	(*ISO)	4 min	---->	Time	Any	8
Character	(*EUR)	4 min	---->	Time	Any	8
Character	(*JIS)	4 min	---->	Time	Any	8
Character	(HHtMMtSS)	8 min	<----	Time	Any	8
Timestamp	SAA format	26	<-->	Timestamp	SAA	26
Zoned	(YYYYMMDDHHMMSS)	14,0	<-->	Timestamp	SAA	26
Character	SAA format	14 min	---->	Timestamp	SAA	26
Character	(YYYYMMDDHHMMSS)	14 min	<-->	Timestamp	SAA	26

Note: In the format columns,

d	= date separator value
t	= time separator value
any	= job formats or SAA formats

In the allowable field-length column, *min* means the specified length is the minimum required for a conversion attempt. Conversion errors may still occur if the length is not long enough for the desired or assumed format. Refer to the *DDS Reference* for more information on the date, time, and timestamp data types and keywords.

When converting a character field to a date, time, or timestamp field; FMTOPT(*MAP) is specified; and the corresponding from- and to-field names match; an attempt is made to determine what similar date form the character field is in. The following applies:

- ***For converting a character field to a date field,*** the minimum length required for the character field is 6. The system first determines if the character field data is in the same format and has the same separator as specified in the current job under which the copy command is running. This may be *MDY, *DMY, *YMD, or *JUL for the format and slash (/), hyphen (-), period (.), comma (,), or blank ( ) for the separator. If the character field is not in the current job specified format and separator form, it determines if it is in one of the SAA formats (*ISO, *USA, *EUR, or *JIS), or if it is in a YYYYDDD form (no separator). If the system determines the character field is in one of the these forms, it converts it to the date to-field. The date portion of the character field must be left justified and can contain trailing blanks.
- ***For converting a character field to a time field,*** the minimum length required for the character field is 4. The system first determines if the character field data is in the same format and has the same separator as specified in the current job under which the copy command is running. This may be *HMS for the format and colon (:), comma (,), period (.), or blank ( ) for the separator. If the character field is not in the current job specified format and separator form, the system determines if it is in one of the SAA formats (*ISO, *USA, *EUR, or *JIS). If the system determines the character field is in one of these forms, it converts it to the time to-field. The time portion of the character field must be left justified and can contain trailing blanks.
- ***For converting a character field to a timestamp field,*** the minimum length required for the character field is 14. The system first determines if the character field data is in one of the following:
  - SAA format
  - YYYYMMDDHHMMSS form

  If the system determines the character field is in one of these forms, it converts it to the timestamp to-field. The timestamp portion of the character field must be left justified and can contain trailing blanks.

When converting a date, time, or timestamp field to a character field; FMTOPT(*MAP) is specified; and the corresponding from and to-file field names match; the system attempts to convert the date, time, or timestamp field into the form specified by the current job. The following applies:

- ***For converting a date field to a character field,*** the minimum length required for the character field is 6. The system first determines the date format and separator attribute of the current job under which the copy command is running. This may be *MDY, *DMY, *YMD, or *JUL for the format and slash (/), hyphen (-), period (.), comma (,), or blank ( ) for the separator. The date field is converted into the character field in the specified format of the current job. For character fields that are longer than required for the conversion, the data is left justified and trailing blanks are added.
- ***For converting a time field to a character field,*** the minimum length required for the character field is 8. The system first determines the time separator attribute of the current job under which the copy command is running. This may be colon (:), comma (,), period (.), or blank ( ). The time field is converted into the character field in the *HMS format (including the specified separator of the current job). For character fields that are longer than required for the conversion, the data is left justified and trailing blanks are added.
- ***For converting a timestamp field to a character field,*** the minimum length required for the character field is 14. The timestamp field is converted into the character field in the YYYYMMDDHHMMSS form (no separators). For character fields that are longer than required for the conversion, the data is left justified and trailing blanks are added.

When converting a zoned decimal field to a date, time, or timestamp field, FMTOPT(*MAP) is specified and the corresponding from- and to-field names match, the system assumes the zoned decimal field is in the form specified by the current job. The following applies:

- ***For converting a zoned decimal field to a date field,*** the system assumes the zoned decimal field data is in the same date format (no separators) as specified in the current job under which the copy command is running. This may be *MDY, *DMY, *YMD, or *JUL. The length of the zoned decimal field must be 5,0 (if the current job format is *JUL) or 6,0 (if the current job format is *MDY, *DMY, or *YMD). The system attempts to convert or copy it to the date to-field.
- ***For converting a zoned decimal field to a time field,*** the system assumes the zoned decimal field data is in the *HMS format (no separators). The length of the zoned decimal field must be 6,0. The system attempts to convert or copy it to the time to-field.
- ***For converting a zoned decimal field to a timestamp field,*** the system assumes the zoned decimal field data is in the YYYYMMDDHHMMSS form (no separators). The length of the zoned decimal field must be 14,0. The system attempts to convert or copy it to the timestamp to-field.

When converting a date, time, or timestamp field to a zoned decimal field, FMTOPT(*MAP) is specified and the corresponding from- and to-field names match, the system uses the current job specified form to determine what format the zoned decimal data should be in. The following applies:

- ***For converting a date field to a zoned decimal field,*** the system assumes the zoned decimal field data is to be in the same date format (no separators) as specified in the current job under which the copy command is running. This may be *MDY, *DMY, *YMD, or *JUL. The length of the zoned decimal field must be 5,0 (if the current job format is *JUL) or 6,0 (if the current job format is *MDY, *DMY, or *YMD). The system attempts to convert or copy the date field to it.
- ***For converting a time field to a zoned decimal field,*** the system assumes the zoned decimal field data is to be in the *HMS format (no separators). The length of the zoned decimal field must be 6,0. The system attempts to convert or copy the time field to it.
- ***For converting a timestamp field to a zoned decimal field,*** the system assumes the zoned decimal field data is to be in the YYYYMMDDHHMMSS form (no separators). The length of the zoned decimal field must be 14,0. The system attempts to convert or copy the timestamp field to it.

Any conversion not successful because of a data value, data format, or data-length error causes an information message to be sent. The to-file field is set with its default value.

Null-Capable Fields: FMTOPT(*MAP) or FMTOPT(*NOCHK) must be specified on the CPYF command if:

The from-file is a database data file.
The to-file is a physical data file.
The record formats are not identical.

For the record formats to be identical, corresponding fields in the from-file and to-file must both be null-capable or not null-capable. For the CPYFRMQRYF command, the same is true except that the open query file record format is used (rather than a from-file format).

When you use FMTOPT(*MAP):

- Null values are copied from null-capable from-file fields to null-capable to-file fields that are named alike. This copying can only happen if the field attributes and lengths are compatible.
- Fields that are not null-capable can also be copied from and to null-capable fields, provided the field attributes and lengths are compatible. The results to expect in the to-file field are:
  - Copying a null-capable field to a null-capable field

    Null values in the from-file field are copied to the to-file field. Values that are not null in the from-file field are also copied to the to-file field. For values that are not null in the from-file field that cause conversion errors during the copy, the default value of the to-file field is placed into the to-file field.
  - Copying a field that is not null capable to a null-capable field

    Values that are not null in the from-file field are copied to the to-file field. For values in the from-file field that cause conversion errors during the copy operation, the default value of the to-file field is placed into the to-file field.

- Copying a null-capable field to a field that is not null capable

  Values that are not null in the from-file field are copied to the to-file field. If a conversion error occurs when copying values that are not null or the from-file field value is null, the to-file field default value is placed into the to-file.

When you use FMTOPT(*NONE), the null values in the from-file are copied to the to-file when copying a database file to a physical data file with identical record formats.

When you use FMTOPT(*DROP), the null values are copied.

When you use FMTOPT(*NOCHK) or FMTOPT(*CVTSRC), the record data is copied directly from left to right into the to-file without any regard to field types. Null values are not copied if *NOCHK or *CVTSRC is specified, because the record formats need not be identical. Either a user-specified or default value is copied to the to-file rather than a null value.

CCSIDs: When FMTOPT(*NOCHK) is specified, no CCSID conversions are done. Record data is copied directly from left to right into the to-file without any regard to field types or CCSIDs.

When FMTOPT(*MAP) is specified and a valid conversion is defined between the CCSID of the from-field and the CCSID of the to-file field, the character data is converted to the CCSID of the to-file field. However, if the CCSID of the from-file field or the CCSID of the to-file field is 65535, no conversions are done.

When FMTOPT(*NONE) is specified, the from-file and to-file attributes must be the same, unless one of the CCSIDs in corresponding fields is 65535.

For the CPYFRMQRYF command, the FMTOPT rules are the same except that the changed query format is used instead of a from-file format. See "CPYFRMQRYF Command Support for CCSIDs" on page 4-9 for information on the modified query format.

DBCS-Graphic Fields: When mapping graphic fields to bracketed DBCS fields, shift-out and shift-in characters are added around the DBCS data. When mapping from bracketed-DBCS fields to graphic fields, the shift-out and shift-in characters are removed. For variable-length fields, the graphic field length is expressed in the number of DBCS characters and the bracketed DBCS length is expressed in number of bytes (including the shift-out and shift-in characters). This difference is accounted for when mapping variable-length graphic fields to or from variable bracketed DBCS fields.

When using the CPYF command with FMTOPT(*MAP) to copy a DBCS-open field to a graphic field, a conversion error occurs if the DBCS-open field contains any SBCS data (including blanks). When copying to a graphic field, it may be desirable to ignore trailing SBCS blanks that follow valid DBCS data (in a DBCS-open field). This allows the copy operation to be done without a conversion error. This type of copy may be done using a combination of the OPNQRYF and CPYFRMQRYF commands. The OPNQRYF command is used to remove trailing single-byte blanks and place the data into a variable-length DBCS-open field. The CPYFRMQRYF command with FMTOPT(*MAP) specified is used to copy the variable-length DBCS-open field to the graphic field.

For example, assume the DBCS-open fields in the file named FILEO are copied into graphic fields in the file named FILEG. An additional file (FILEV) must be created.

The DDS for the original from-file FILEO:

```
******* ************** Beginning of data *****************************
0001.00     A          R FMT01
0002.00     A            FLD1          100          CCSID(65535)
0003.00     A            FLD2           70          CCSID(65535)
0004.00     A            FLD3          20A
******* ***************** End of data ********************************
```

DDS for FILEV: This file's format will be specified on the OPNQRYF command FORMAT parameter. The only difference from FILEO is that the DBCS-open fields to be converted to graphic fields are defined to be variable length.

```
******* ************** Beginning of data *****************************
0001.00     A          R FMT01
0002.00     A            FLD1          100         VARLEN CCSID(65535)
0003.00     A            FLD2           70         VARLEN CCSID(65535)
0004.00     A            FLD3          20A
******* ***************** End of data ********************************
```

DDS for the new file FILEG: The graphic fields are defined as fixed length; however, they could be made variable length, if desired.

```
******* ************** Beginning of data *****************************
0001.00     A          R FMT01
0002.00     A            FLD1           4G         CCSID(65535)
0003.00     A            FLD2           3G         CCSID(65535)
0004.00     A            FLD3          20A
******* ***************** End of data ********************************
```

The following commands are used to copy the data from the DBCS-open fields in FILEO to the graphic fields in FILEG:

```
CHGJOB CCSID(65535)
OPNQRYF FILE((MYLIB/FILEO))
       FORMAT(MYLIB/FILEV *ONLY)
       MAPFLD((FLD1 '%STRIP(1/FLD1 *TRAIL)')
              (FLD2 '%STRIP(1/FLD2 *TRAIL)'))

CPYFRMQRYF FROMOPNID(FILEO) TOFILE(MYLIB/FILEG)
          MBROPT(*REPLACE) FMTOPT(*MAP)
```

For more information on coping DBCS fields, see “Copying Files” on page B-9.

Conversion Rules

Table 4-7 on page 4-35 shows the field conversions that are allowed between mapped fields in the from-file and to-file record formats. If fields with the same name have incompatible attributes between the from-file and to-file formats, only FMTOPT(*NOCHK) can be used to perform the copy. An X indicates that the conversion is valid, and a blank indicates a field mapping that is not valid.

When mapping character fields, the field being copied is truncated on the right if it is longer than the field into which the copy is made. For example, a character field of length 10 is copied into a character field of length 6; ABCDEFGHIJ becomes ABCDEF. If the field being copied is shorter than the field into which it is copied, the field is padded on the right with blanks. For example, a character field of length 10 is copied into a character field of length 12; ABCDEFGHIJ becomes ABCDEFGHIJxx (x = blank).

When mapping numeric fields and the field being copied is longer than the field into which the copy is made, the field being copied is truncated on the left and right of the decimal point. For example, a zoned decimal field of length 9 with 4 decimal positions is copied to a zoned decimal field of length 6 with 3 decimal positions; 00115.1109 becomes 115.110.

If significant digits must be truncated to the left of the decimal point, the value is not copied, and the field is set to its default value (either the parameter value of the DFT keyword, if specified, or zero, if the DFT keyword is not specified). Also, if significance will be lost because a floating-point numeric value exponent is too large, the to-file field is set to its default value.

When mapping numeric fields and the field being copied is shorter than the field into which the copy is made, the field being copied is padded with zeros on the left and right of the decimal point. For example, a packed decimal field of length 7 with 5 decimal positions is copied to a packed decimal field of length 10 with 6 decimal positions; 99.99998 becomes 0099.999980.

Table 4-7. Field Conversions

From Field	To Character or Hexadecimal Field	To Packed Decimal Field	To Zoned Decimal Field	To Binary (No Decimals Positions) Field	To Floating Point Field	To Binary Field (with Decimals Positions)
Character or Hexadecimal	X					
Packed		X	X	X	X	
Zoned		X	X	X	X	
Binary (no decimal positions)		X	X	X	X	
Floating Point		X	X	X	X	
Binary (with decimal positions)						X[1]

1 A binary numeric field with one or more decimal positions can be copied only to a binary field with the same number of decimal positions.

Adding or Changing Source File Sequence Number and Date Fields (SRCOPT and SRCSEQ Parameters)

(CPYF and CPYSRCF commands)

Copying Device Source Files to Database Source Files

When you copy from a device source file to a database source file, the system adds sequence number and date fields at the start of the records. The first record is assigned a sequence number of 1.00, the next 2.00, and so on, increasing in increments of 1.00. If more than 9999 records are copied, the sequence number is wrapped back to 1.00 and continues to be incremented unless the SRCOPT and SRCSEQ parameters are specified on the copy command. Date fields are initialized to zeroes. If several copies to the same file are made with MBROPT(*ADD) specified, you will have duplicate sequence numbers in the file. This can be corrected using the Reorganize Physical File Member (RGZPFM) command.

When copying to or from a device, it is more efficient to use a device data file than a device source file. The copy function automatically adds or removes the source sequence number and date fields as necessary.

Copying Database Source Files to Device Source Files

When you are copying to a device source file, the system removes the date and sequence number fields from the start of the records.

When copying to or from a device, it is more efficient to use a device data file than a device source file. The copy function automatically adds or removes the source sequence number and date fields as necessary.

Copying Database Source Files to Database Source Files

You can copy between database source files by using the CPYSRCF or CPYF command. The CPYSRCF command may be easier to use because the parameter defaults are particularly suited for copying database source files.

Note: When TOFILE(*PRINT) is specified, the CPYSRCF command uses a format to show source information that is easy to read. Also, for multiple member copies, the members are listed (and copied) in alphabetical order. When you copy from a database source file to a database source file the sequence number and date fields are not changed unless the SRCOPT parameter is specified. If SRCOPT(*SEQNBR) is specified, the sequence numbers are updated. If SRCOPT(*DATE) is specified, the date field is initialized to 0. Both *SEQNBR and *DATE can be specified.

If SRCOPT(*SEQNBR) is specified in order to update the sequence numbers, the SRCSEQ parameter is taken into consideration. The SRCSEQ parameter specifies the starting value assigned to the first record copied and the increment value. The defaults are 1.00 and 1.00. A whole number of no more than 4 digits and/or a fraction of no more than 2 digits can be specified for the starting value and the increment value. You must use a decimal point for fractions. If you specify SRCSEQ(100.50), then the records copied will have sequence numbers 100.00, 100.50, 101.00, 101.50, and so on.

If the file to be copied contains more than 9999 records, a fractional increment value should be used so that each record has a unique sequence number. If a starting value of .01 and an increment value of .01 are specified, the maximum number of records copied with unique sequence numbers is 999 999. When the maximum sequence number is exceeded (9999.99), all remaining records on that copy are initialized to 9999.99. The system does not wrap back to 1.00.

If the database source file being copied to has only an arrival sequence access path, then because the file does not have a keyed sequence access path (arranged by sequence number), records cannot be inserted in the middle of the file keyed access path. The records are always physically placed at the end of the file.

Recoverable Error Considerations (ERRLVL Parameter)

(CPYF and CPYFRMQRYF commands)

When you are copying to or from a database file | or from a tape file, you can limit the number of recoverable errors that you accept before the copy is ended. Use the ERRLVL parameter to specify this limit. The types of errors this parameter applies to are:

CPF4826	Media error
CPF5026	Duplicate key in the access path of this member
CPF5029	Data or key conversion error
CPF5030	Partial damage on member
CPF5034	Duplicate key in the access path of another member
CPF5036	Invalid length tape block read
CPF5097	*NAN (Not a Number) value not allowed in floating-point key field

The ERRLVL parameter specifies the maximum number of recoverable errors allowed for each member or label pair copied. Note that the value specified for ERRLVL indicates the total errors allowed on both the from-file and the to-file combined for each member or label pair copied. Each time an error occurs, (1) the count for that member or label pair is increased by 1, (2) a message identifying the last good record read or written is printed on all copy lists if TOFILE(*PRINT), PRINT(*COPIED), or PRINT(*EXCLD) was specified, and (3) copying continues. If the from-file member is completely copied without exceeding the limit, the counter is reset to 0, and the copy of the next member is started. If the limit is exceeded during the copy of a member, copying ends and a message is sent, even if there are more records or additional members to be copied.

For a database from-file, including the open query file, the recoverable errors are those that occur when data is converted (mapped) and those caused by a damaged area on the disk (in auxiliary storage). For a tape from-file, the recoverable errors are (1) a block length that is not valid and (2) a media-read operation from the tape volume on the device resulting in an error. For a physical to-file, the recoverable errors are those that occur when data is converted and those that occur when more than one of the same key is found. Any record that causes an error is not copied to the to-file, but for a write error the record is printed on a PRINT(*COPIED) and PRINT(*EXCLD) printout, followed by a message in the printout indicating that the record was not actually copied. For a read error, no record is available to be printed on the copy printouts (TOFILE(*PRINT), PRINT(*COPIED), or PRINT(*EXCLD)), but a message is printed on all printouts specified indicating that a record could not be read.

Partial object damage to the contents of a database file is an error that occurs when a portion of the file cannot be read from disk. If a file is damaged in such a way, you can bypass records in error by copying the good records and manually adding the records that were not copied because of the damage.

Regardless of the value of the ERRLVL parameter, recoverable errors will always appear in the job log with a reply of "C" for "Cancel."

Date, Time, and Timestamp Considerations

For FMTOPT(*MAP), FROMKEY with *BLDKEY, TOKEY with *BLDKEY, and INCREL parameters, 2-digit year-date fields or values will be assumed to have a century of 19 if the year is in the range from 40 to 99, or a century of 20 if the year is in the range from 00 to 39. For example, 12/31/91 is considered December 31, 1991, while 12/31/38 is considered December 31, 2038.

However, any from-files containing 2-digit year-date fields with actual internal date values outside the range January 1, 1940 to December 31, 2039 cause input mapping errors, and the copy operation fails.

When FMTOPT(*MAP) is used to convert or copy a from-file field date value in a 4-digit year form to a 2-digit year form, the from-file field value must be within the range of January 1, 1940 to December 31, 2039. Otherwise, a mapping error occurs and the to-file field is set with its default value. Likewise, when using a 4-digit year date as a record selection input string on FROMKEY with *BLDKEY or TOKEY with *BLDKEY, the value must be within the same range if the corresponding from-file field is a date field with a 2-digit year-date. Otherwise, an error occurs. INCREL record selection is the exception to this rule, as 4-digit year date values outside this range may be used (and will be treated as such) for corresponding 2-digit year-date fields.

When mapping a character field to a date, time, or timestamp field and an SAA format form is being used in the character field, leading zeros may be omitted from month, day, and hour parts, and microseconds may be truncated or omitted entirely in the character field. For mapping to time fields, the seconds part (and corresponding separator) may be omitted from the character field (also if it is in an SAA form). For SAA *USA form values, the AM or PM with a preceding blank is required. These rules are also true for date, time, or timestamp values entered when using FROMKEY with *BLDKEY, TOKEY with *BLDKEY, or INCREL parameters on the CPYF command, which also accept shortened SAA forms. All other instances of date, time, and timestamp data require leading zeros when necessary and no truncation.

For both forms of the TOKEY parameter (*BLDKEY or non-*BLDKEY) the from-field data must be in a particular format for a chronological comparison to be made. For the date field, the format must be SAA *ISO or SAA *JIS for a chronological comparison to be made. For the time fields, the format must be *HMS, SAA *ISO, | SAA *EUR, or SAA *JIS for the chronological comparison to be made. For the timestamp fields, the SAA format allows the chronological comparison. For any other formats of date or time fields | (for date (*MDY, *DMY, *YMD, *JUL, SAA *EUR, | or SAA *USA) or for time (SAA *USA)), chronological comparisons are not possible because the TOKEY parameter performs a straight character string comparison. When chronological comparisons cannot be made, an informational message is sent and the copy operation continues.

When copying data into a file with date, time, or timestamp fields, and the from-file is a device file or FMTOPT(*NOCHK) or FMTOPT(*CVTSRC) has been specified, output mapping errors may occur if the data copied to a date, time, or timestamp field is not valid data for the to-file field format and separator attributes. The record is not copied if this occurs. If the CPYF or CPYFRMQRYF command is being used, an error level other than zero (ERRLVL parameter) may be specified to bypass the record and continue the copy operation. When copying into date, time, or timestamp fields in these instances, it is important that the from-file data is valid for the to-file.

Position Error Considerations

A position error occurs when the copy file function cannot locate the first record to be copied in the from-file member. This can happen when using the CPYF, CPYSRCF, CPYTODKT, or CPYTOTAP commands. If any of the following are true, you may receive a position error for the from-file member:

- The FROMKEY parameter is specified and all records in the member are less than the FROMKEY value or the member is empty.
- The FROMRCD parameter is specified beyond the end of the member or the member is empty.
- The value of the from-file member position (the POSITION parameter of the OVRDBF command) is beyond the end of the member, is not valid for the access path of the from-file, or the member is empty.

If a member position error occurs, the member may not be added to the to-file, and no information about the member will be added to the print lists.

If a member position error occurs during a copy operation involving multiple members, the copy operation will continue with the next member.

If a member position error occurs for all members being copied, a print list will not be produced and the to-file may not be created.

Allocation Considerations

When a database file is copied, each from-file member is allocated with a shared-for-read (*SHRRD) lock state. The member is only allocated while it is being copied. When a device file is copied, it is allocated with a shared-for-read (*SHRRD) lock state. Generally, the member being copied to is allocated with a shared-for-update (*SHRUPD) lock state. However, if MBROPT(*REPLACE) is specified, the member being copied to is allocated with an exclusive (*EXCL) lock state, and the records in the file being copied to are removed. A shared-for-read lock state lets other users read and update the file while it is being copied.

When you are copying one physical file to another, stronger locks *may* be placed on the members to allow internal system functions to perform the copy.

- The from-file member can be allocated with an exclusive-allow-read (*EXCLDRD) lock state.
- The to-file member can be allocated with an exclusive (*EXCL) lock state.

These stronger locks are required when COMPRESS(*NO) is specified. If you cannot get them, the copy operation may be performed with COMPRESS(*YES) specified instead.

If a member is allocated by another job with too strong a lock state, or if the library containing the file is renamed during the copy operation, the copy operation may end with an error message.

During the time a copy command request is run, the file named on the TOFILE parameter may be locked (similar to an *EXCL lock with no time-out) so that no access is possible. Any attempt to use a function that must touch the TOFILE object locks up a work station until the copy command is done running. Following are examples of functions that should not be used on a file being copied into by a copy command:

WRKACTJOB
  Option 11 (Work with Locks)
  Option 5 (Work with Job Member Locks)
  Option 8 (Work with Object Locks)
DSPDBR
DSPFD
DSPFFD
WRKJOB
  Option 12 (Work with Locks, if active)
  Option 5 (Work with Job Member Locks)
  F10 (Display Open Files, if active)
WRKLIB
  The library containing the to-file
DSPLIB
  The library containing the to-file
WRKOBJLCK
WRKRCDLCK

If you want to display any information about a file into which data is being copied by a copy command, you must anticipate the requirement and force the copy command to use block record-at-a-time operations by specifying ERRLVL(1).

If you anticipate that problems may arise because of this, you can preallocate the files and members using the Allocate Object (ALCOBJ) command. (See the *CL Programmer's Guide* for information about preallocating objects.)

Authority

The following table summarizes the authority required for the from-file and the to-file to perform a copy operation.

Table 4-8. Authority Required to Perform Copy Operation

	From-File	To-File
DDM file	*OBJOPR *READ	*OBJOPR[1] *ADD
Device file[2]	*OBJOPR *READ	*OBJOPR *READ
Logical file	*OBJOPR[3]	Not allowed
Physical file	*OBJOPR *READ	*OBJOPR[1] *ADD

1 This is the authority required for MBROPT(*ADD). If MBROPT(*REPLACE) is specified, *OBJMGT and *DLT authority are also required.

| 2 *OBJOPR and *READ authority is also required for any devices used for the file.

3 Also requires *READ authority to the based-on physical file members for the logical file members copied.

If the to-file does not exist and CRTFILE(*YES) is specified so that the copy command will create the to-file, then you must have operational authority to the CRTPF command.

Performance

The performance of the copy operation depends on the types of files copied, the file attributes, and the optional copy parameters specified.

A copy that requires maintenance of a keyed sequence access path is slower than a copy from or to an arrival sequence access path. Copy performance will be improved if the from-file is reorganized so that its arrival sequence is the same as its keyed sequence access path, or if records are selected using the FROMRCD or TORCD parameter, so that the keyed sequence access path is not used.

The fewer logical access paths there are over the to-file, the faster the copy will be, because those access paths have to be updated as the records are copied.

The smaller the record lengths of the file, the faster the copy.

In general, the fewer optional copy parameters specified, the faster the copy. The following parameters affect the performance of the copy operation:

INCCHAR
INCREL
ERRLVL
FMTOPT
SRCOPT
PRINT

Using the COMPRESS function does not significantly affect performance. You should request COMPRESS(*NO) if you want deleted records in the to-file, for example, when the relative record numbers need to be identical.

Chapter 5. Spool Support

Spooling functions help system users to manage input and output operations more efficiently. The system supports two types of spooling:

- *Output spooling* sends job output to disk storage, rather than directly to a printer or diskette output device. Output spooling allows the job producing the output to continue processing independently of the speed or availability of output devices.
- *Input spooling* accepts job input, stores the input data in disk storage to await processing, and allows the input device to be used independently of when the job is actually processed.

Output spooling may be used for both printer and diskette devices; input spooling applies to diskette and database file input.

This chapter discusses both output and input spooling, including advanced output spooling support, such as using multiple output queues and redirecting files. For more information about spooling support for printer and diskette devices, see the *Guide to Programming for Printing* and the *Guide to Programming for Tape and Diskette*, respectively.

Output Spooling Overview

Output spooling allows the system to produce output on multiple output devices, such as printer and diskette devices, in an efficient manner. It does this by sending the output of a job destined for a printer or diskette to disk storage. This process breaks a potential job limitation imposed by the availability or speed of the output devices.

Spooling is especially important in a multiple-user environment where the number of jobs running often exceeds the number of available output devices. Using output spooling, the output can be easily redirected from one device to another.

The main elements of output spooling are:

Device description
A description of the printer or diskette device

Spooled file
A file containing spooled output records that are to be processed on an output device

Output queue
An ordered list of spooled files

Writer
A program that sends files from an output queue to a device

Application program
A high-level language program that creates a spooled file using a device file with the spooling attribute specified as SPOOL(*YES)

Device file
A description of the format of the output, and a list of attributes that describe how the system should process the spooled file

Figure 5-1 shows the relationship of these spooling elements.

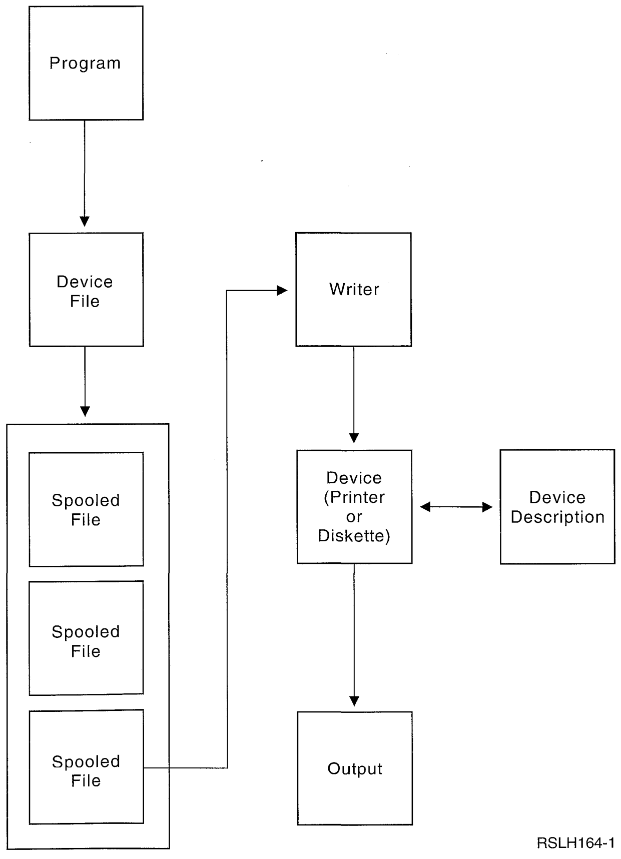


Figure 5-1. Relationship of Output Spooling Elements

Output spooling functions are performed by the system without requiring any special operations by the program that produces the output. When a device file is opened by a program, the operating system determines whether the output is to be spooled. When a printer or diskette device file specifying spooling is opened, the spooled file containing the output of the program is placed on the appropriate output queue in the system.

A spooled file can be made available for printing when the printer file is opened, when the printer file is closed, or at the end of the job. A printer writer is started in the spooling subsystem to send the records to the printer. The spooled file is selected from an output queue. The same general description applies for spooled diskette files.

Device Descriptions

Device descriptions must be created for each printer and diskette device to define that device to the system. Printer device descriptions are created using the Create Device Description for Printer (CRTDEVPRT) command; diskette device descriptions are created using the Create Device Description for Diskette (CRTDEVDKT) command. See the *Device Configuration Guide* for more information about specifying device descriptions.

Summary of Spooled File Commands

The following commands may be used to work with spooled files. For detailed descriptions of the commands, see the *CL Reference*.

CHGSPLFA
: Change Spooled File Attributes: Allows you to change some attributes of a spooled file, such as the output queue name or the number of copies requested, while the spooled file is on an output queue.

CPYSPLF
: Copy Spooled File: Copies a spooled file to a specified database file. The database file may then be used for other applications, such as those using microfiche or data communications.

DLTSPLF
: Delete Spooled File: Deletes a spooled file from an output queue.

DSPSPLF
: Display Spooled File: Allows you to display data records of a spooled file.

HLDSPLF
: Hold Spooled File: Stops the processing of a spooled file by a spooling writer. The next spooled file in line will be processed.

RLSSPLF
: Release Spooled File: Releases a previously held spooled file for processing by a spooling writer.

SNDNETSPLF
: Send Network Spooled File: Sends a spooled file to another system user on the Systems Network Architecture distribution services (SNADS) network.

WRKSPLF
: Work with Spooled Files: Allows you to display or print a list of spooled files on the system.

WRKSPLFA
: Work with Spooled File Attributes: Shows the current attributes of a spooled file.

Locating Your Spooled Files

The Work with Spooled Files (WRKSPLF) command can be used to display or print all the spooled files that you have created. This is the easiest way to find your spooled files if you do not know the name of the output queue where they have been placed. To find all spooled files created by your current job, use the Work with Job (WRKJOB) command and choose Option 4 to work with the spooled files.

File Redirection

File redirection occurs when a spooled file is sent to an output device other than the one for which it was originally intended. File redirection may involve devices that process different media (such as printer output sent to a diskette device) or devices that process the same type of media but are of different device types (such as 5219 Printer output sent to a 4224 Printer).

Depending on the new output device for the spooled file, the file may be processed just as it would have been on the originally specified device. However, differences in devices often cause the output to be formatted differently. In these cases, the system sends an inquiry message to the writer's message queue to inform you of the situation and allow you to specify whether you want printing to continue. For more information about print file redirection, see the *Guide to Programming for Printing*.

Output Queues

Batch and interactive job processing may result in spooled output records that are to be processed on an output device, such as a printer or diskette drive. These output records are stored in spooled files until they can be processed. There may be many spooled files for a single job.

When a spooled file is created, the file is placed on an output queue. Each output queue contains an ordered list of spooled files. A job can have spooled files on one or more output queues. All spooled files on a particular output queue should have a common set of output attributes, such as device, form type, and lines per inch. Using common attributes on an output queue reduces the amount of intervention required and increases the device throughput.

The following lists the parameters on the Create Output Queue (CRTOUTQ) command and what they specify:

- DSPDTA: Whether users without any special authority but who do have *USE authority to the output queue can display, copy, or send the contents of spooled files other than their own. By specifying *OWNER for DSPDTA, only the owner of the file or user with *SPLCTL can display, copy, or send a file.
- JOBSEP: How many, if any, job separator pages are to be printed between the output of each job when the output is printed.
- DTAQ: The data queue associated with this output queue. If specified, an entry is sent to the data queue whenever a spooled file goes to Ready Status on the queue.
- OPRCTL: Whether a user having job control authority can control the output queue (for example, if the user can hold the output queue).
- SEQ: Controls the order in which spooled files will be sorted on the output queue. See "Order of Spooled Files on an Output Queue" on page 5-4 for more information.
- AUTCHK: Specifies what type of authority to the output queue will enable a user to control the spooled files on the output queue (for example, enable the user to hold the spooled files on the output queue).
- AUT: Public authority. Specifies what control users have over the output queue itself.
- TEXT: Text description. Up to 50 characters of text that describes the output queue.

Summary of Output Queue Commands

The following commands may be used to create and control output queues. For detailed descriptions of the commands, see the *CL Reference* manual.

CHGOUTQ
: Change Output Queue: Allows you to change certain attributes of an output queue, such as the sequence of the spooled files on the output queue.

CLROUTQ
: Clear Output Queue: Removes all spooled files from an output queue.

CRTOUTQ
: Create Output Queue: Allows you to create a new output queue.

DLTOUTQ
: Delete Output Queue: Deletes an output queue from the system.

HLDOUTQ
: Hold Output Queue: Prevents all spooled files on a particular output queue from being processed by a spooling writer.

RLSOUTQ
: Release Output Queue: Releases a previously held output queue for processing by a spooling writer.

WRKOUTQ
: Work with Output Queue: Shows the overall status of all output queues, or the detailed status of a specific output queue and its spooled files.

WRKOUTQD
Work with Output Queue Description: Shows descriptive information for an output queue.

Default Printer Output Queues

When a printer is configured to the system, the system automatically creates the printer's default output queue in library QUSRSYS. The output queue is given a text description of `'Default output queue for printer xxxxxxxxxx'`, where `xxxxxxxxxx` is the name of the printer.

The AUT parameter for the output queue is assigned the same value as that specified by the AUT parameter for the printer device description. All other parameters are assigned their default values. Use the Change Command Default (CHGCMDDFT) command to change the default values used when creating output queues with the CRTOUTQ command.

The default output queue for a printer is owned by the user who created the printer device description. In the case of automatic configuration, both the printer and the output queue are owned by the system profile QPGMR.

Default System Output Queues

The system is shipped with the defaults on commands to use the default output queue for the system printer as the default output queue for all spooled output. The system printer is defined by the QPRTDEV system value.

When a spooled file is created by opening a device file and the output queue specified for the file cannot be found, the system will attempt to place the spooled file on output queue QPRINT in library QGPL. If for any reason the spooled file cannot be placed on output queue QPRINT, an error message will be sent and the output will not be spooled.

The following output queues are supplied with the system:

QDKT	Default diskette output queue
QPRINT	Default printer output queue
QPRINTS	Printer output queue for special forms
QPRINT2	Printer output queue for 2-part paper

Creating Your Own Output Queues

You can create output queues for each user of the system. For example:

```
CRTOUTQ OUTQ(QGPL/JONES) +
  TEXT('Output queue for Mike Jones')
```

Order of Spooled Files on an Output Queue

The order of spooled files on an output queue is mainly determined by the status of the spooled file. A spooled file that is being processed by a writer may have a status of printing (PRT status), writer (WTR status), or pending to be printed (PND status). Spooled files with these statuses are placed at the top of the output queue. A spooled file being processed by the writer may have a held (HLD) status if a user has held the spooled file, but the writer is not yet finished processing the file. All other files with a status of RDY are listed on the output queue after the file being processed by a writer, followed by files with statuses other than RDY.

Within each type of spooled file (RDY and non-RDY files) the following information causes a further ordering of the files. The items are listed in sequence based on the amount of importance they have on the ordering of spooled files, with the first item having the most importance.

1. The output priority of the spooled file.
2. A date and time field (time stamp).

   For output queues with SEQ(*JOBNBR) specified, the date and time that the job which created the spooled file entered the system are the date and time field. (A sequential job number is also assigned to the job when it enters the system.)

   For output queues with SEQ(*FIFO) specified, the date and time field is set to the current system date and time when any of the following occur:

   - A spooled file is created by opening a device file.
   - The output priority of the job which created the spooled file is changed.
   - The status of the spooled file changes from RDY to HLD, SAV, OPN, or CLO; or

the status changes from HLD, SAV, OPN, or CLO to RDY.
   - A spooled file is moved to another output queue which has SEQ(*FIFO) specified.
3. The SCHEDULE parameter value of the spooled file.

   Files with SCHEDULE(*JOBEND) specified are grouped together and placed after other spooled files of the same job that have SCHEDULE(*IMMED) or SCHEDULE(*FILEEND) specified.
4. The spool number of the file.

Because of the automatic sorting of spooled files, different results occur when SEQ(*JOBNBR) is specified for an output queue than when SEQ(*FIFO) is specified. For example, when a spooled file is held and then immediately released on an output queue with SEQ(*JOBNBR) specified, the file will end up where it started; but if the same file were held and then immediately released on an output queue with SEQ(*FIFO) specified, the file would be placed at the end of the spooled files which have the same priority and a status of RDY.

Using Multiple Output Queues

You may want to create multiple output queues for:

- Special forms printing
- Output to be printed after normal working hours
- Output that is not printed

  An output queue can be created to handle spooled files that need only to be displayed or copied to a database file. Care should be taken to remove unneeded spooled files.
- Special uses

  For example, each programmer could be given a separate output queue.
- Output of special IBM files

  You may want to consider separate queues for the following IBM-supplied files:

  - QPJOBLOG: You may want all job logs sent to a separate queue.
  - QPPGMDMP: You may want all program dumps sent to a separate queue so you can review and print them if needed or clear them daily.
  - QPSRVDMP: You may want all service dumps sent to a separate queue so the service representative can review them if needed.

Output Queue Recovery

If a job that has produced spooled files is running when the job or system stops abnormally, the files remain on the output queue. Some number of records written by active programs may still be in main storage when the job ends and will be lost. You should check these spooled files to ensure that they are complete before you decide to continue using the files.

You can use the SPLFILE parameter on the End Job (ENDJOB) command to specify if all spooled files (except QPJOBLOG) created by the job are to be kept for normal processing by the writer, or if these files are to be deleted.

If an abnormal end occurs, the spooled file QPJOBLOG will be written at the next IPL of the system.

If a writer fails while a spooled file is being printed, the spooled file remains on the output queue intact.

If an output queue becomes damaged such that it cannot be used, you will be notified by a message sent to the system operator message queue. The message will come from a system function when a writer or a job tries to put or take spooled files from the damaged queue.

A damaged output queue can be deleted using the Delete Output Queue (DLTOUTQ) command, or it will be deleted by the system during the next IPL. After a damaged output queue is deleted, all spooled files on the damaged output queue are moved to output queue QSPRCLOUTQ in library QRCL. This is done by the QSPLMAINT system job, which issues completion message CPC3308 to the QSYSOPR message queue when all spooled files have been moved to the QSPRCLOUTQ output queue.

After the damaged output queue is deleted, it can be created again by entering the Create Output Queue (CRTOUTQ) command. Spooled files on output queue QSPRCLOUTQ can be moved back to the newly created output queue using the Change Spooled File Attributes (CHGSPLFA) command.

Note: If the output queue that was damaged was the default output associated with a printer, the system will automatically re-create the output queue when it is deleted. This system-created output queue will have the same public authority as specified for the device and default values for the other parameters. After the system re-creates the output queue, you should verify its attributes are correct and change them as needed. The output queue can be changed using the Change Output Queue (CHGOUTQ) command. When a damaged output queue associated with a printer is deleted and created again, all spooled files on the damaged queue will be moved to the re-created output queue. This is done by the QSPLMAINT system job, which issues completion message CPC3308 to the QSYSOPR message queue when all spooled files have been moved.

Spooling Writers

A writer is an OS/400 program that takes spooled files from an output queue and produces them on an output device. The spooled files that have been placed on a particular output queue will remain stored in the system until a writer is started to the output queue.

The writer takes spooled files one at a time from the output queue, based on their priority. The writer processes a spooled file only if its entry on the output queue indicates that it has a ready (RDY) status. You can display the status of a particular spooled file using the Work with Output Queue (WRKOUTQ) command.

If the spooled file has a ready status, the writer takes the entry from the output queue and prints the specified job and/or file separators, followed by the output data in the file. If the spooled file does not have a ready status, the writer leaves the entry on the output queue and goes on to the next entry. In most cases the writer will continue to process spooled files (preceded by job and file separators) until all files with a ready status have been taken from the output queue.

The AUTOEND parameter on the start writer commands determines whether the writer continues to wait for new spooled files to become available to be written, end after processing one file, or end after all spooled files with ready status have been taken from the output queue.

Summary of Spooling Writer Commands

The following commands may be used to control spooling writers. For detailed descriptions of the commands, see the *CL Reference* manual.

STRDKTWTR
: Start Diskette Writer: Starts a spooling writer to a specified diskette device to process spooled files on that device.

STRPRTWTR
: Start Printer Writer: Starts a spooling writer to a specified printer device to process spooled files on that device.

CHGWTR
: Change Writer: Allows you to change some writer attributes, such as form type, number of file separator pages, or output queue attributes.

HLDWTR
: Hold Writer: Stops a writer at the end of a record, at the end of a spooled file, or at the end of a page.

RLSWTR
: Release Writer: Releases a previously held writer for additional processing.

ENDWTR
: End Writer: Ends a spooling writer and makes the associated output device available to the system.

Spooled File Security

Spooled file security is primarily controlled through the output queue which contains the spooled file. In general, there are four ways that a user can become authorized to control a spooled file (for example, hold or release the spooled file):

- User is assigned spool control authority (SPCAUT(*SPLCTL)) in the user's user profile.

- User is assigned job control authority (SPCAUT(*JOBCTL)) in the user's user profile and the output queue is operator controllable (OPRCTL(*YES)).
- User has the required object authority for the output queue. The required object authority is specified by the AUTCHK keyword on the CRTOUTQ command. A value of *OWNER indicates that only the owner of the output queue is authorized via the object authority for the output queue. A value of *DTAAUT indicates that users with *CHANGE authority to the output queue are authorized to control the output queue.

  Note: The specific authority required for *DTAAUT are *READ, *ADD, and *DLT data authorities.
- A user is always allowed to control the spooled files created by that user.

For the Copy Spooled File (CPYSPLF), Display Spooled File (DSPSPLF), and Send Network Spooled File (SNDNETSPLF) commands, in addition to the four ways already listed, there is an additional way a user can be authorized. If DSPDTA(*YES) was specified when the output queue was created, any user with *USE authority to the output queue will be allowed to run these commands. The specific authority required is
| *READ data authority. Copying, displaying,
| sending, and moving a file to another output
| queue by changing the spooled file can be limited
| by specifying DSPDTA(*OWNER). Then only the owner of the spooled file or user with *SPLCTL can perform these operations on the spooled file.

See the *CL Reference* manual for details about the authority requirements for individual commands.

To place a spooled file on an output queue, one of the following authorities is required:

- User is assigned spool control authority (SPCAUT(*SPLCTL)) in the user's user profile.
- User is assigned job control authority (SPCAUT(*JOBCTL)) in the user's user profile and the output queue is operator controllable (OPRCTL(*YES)).
- User has *READ authority to the output queue. This authority can be given to the public by specifying (AUT(*USE)) on the CRTOUTQ command.

Controlling the Number of Spooled Files in Your System

The number of spooled files in your system should be limited. When a job is completed, spooled files and internal job control information are kept until the spooled files are printed or canceled. The number of jobs on the system and the number of spooled files known to the system increase the amount of time needed to perform IPL and internal searches, and increases the amount of temporary storage required.

The number of jobs known to the system can be displayed using the Work with System Status (WRKSYSSTS) command.

You can use the Work with Spooled Files (WRKSPLF) command to identify spooled files that are no longer needed. By periodically entering the command:

```
WRKSPLF SELECT(*ALL)
```

you can determine which spooled files are older than 2 or 3 days, then delete the spooled files or contact the users who created them.

For detailed information on minimizing the number of job logs (for example, by using LOG(4 0 *NOLIST)), see the *CL Programmer's Guide*. For information regarding the use of system values to control the amount of storage associated with jobs and spooled files, refer to the *Work Management Guide*. To control the storage used on your system see "Spooling Library" on page 5-13.

Command Examples for Additional Spooling Support

You can define some functions to provide additional spooling support. Example source and documentation for the commands, files, and programs for these functions are part of library QUSRTOOL, which is an optionally installed part of the OS/400 program.

The spooling support is part of the Programming and System Management Tips and Techniques section of QUSRTOOL. See the member

AAAMAP in file QATTINFO of library QUSRTOOL for information on where the documentation and example source is located for each of these functions.

Examples of spooling functions in QUSRTOOL are:

Duplicate Spooled File (DUPSPLF) Command Example: The DUPSPLF command can be created to duplicate a spooled file and place the duplicate output in a different output queue. You can do this when you want the same spooled output to be printed on multiple printers and each printer normally works with a specific output queue.

Convert Output Queue (CVTOUTQ) Command Example: In some environments, you may want a function to place the information displayed by the WRKOUTQ command into a database file for processing. Each database record will contain some of the attributes of a spooled file and can be manipulated with other processing techniques, such as assigning a different output queue to all the spooled files.

Move Spooled File (MOVSPLF) Command Example: A typical use of the previously described CVTOUTQ command example is to move all spooled files from one queue to another. The Move Spooled File (MOVSPLF) command example performs this function.

Input Spooling Support

Input spooling takes the information from the input device, prepares the job for scheduling, and places an entry in a job queue. Using input spooling, you can usually shorten job run time, increase the number of jobs that can be run sequentially, and improve device throughput.

The main elements of input spooling are:

Job queue
An ordered list of batch jobs submitted to the system for running and from which batch jobs are selected to run.

Reader
A function that takes jobs from an input device or a database file and places them on a job queue.

When a batch job is read from an input source by a reader, the commands in the input stream are stored in the system as requests for the job, the inline data is spooled as inline data files, and an entry for the job is placed on a job queue. The job information remains stored in the system where it was placed by the reader until the job entry is selected from the job queue for processing by a subsystem. Figure 5-2 shows this relationship.

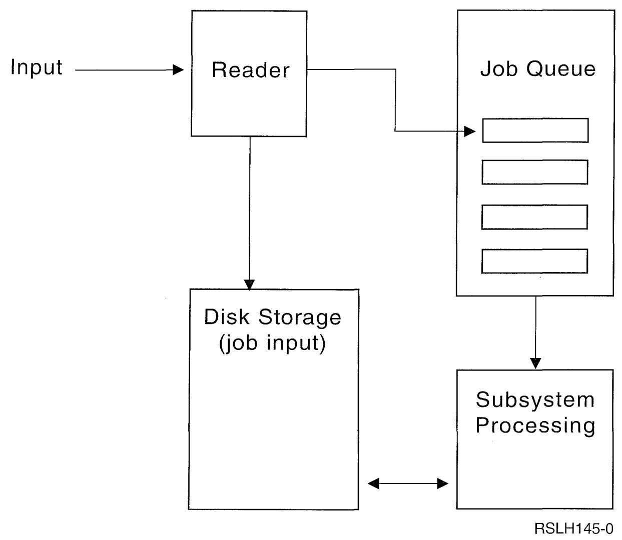


Figure 5-2. Relationship of Input Spooling Elements

You can use the reader functions to read an input stream from diskette or database files. Figure 5-3 shows the typical organization of an input stream:

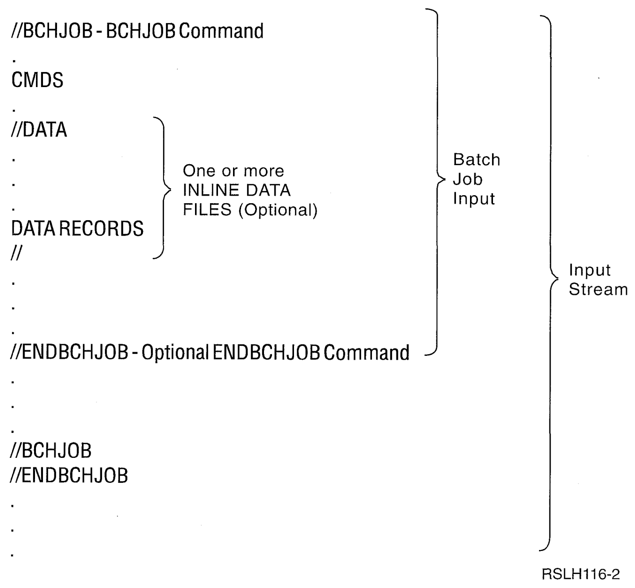

//BCHJOB - BCHJOB Command
CMDS
//DATA
DATA RECORDS
//
One or more INLINE DATA FILES (Optional)
Batch Job Input
//ENDBCHJOB - Optional ENDBCHJOB Command
//BCHJOB
//ENDBCHJOB
Input Stream
RSLH116-2

Figure 5-3. Typical Organization of an Input Stream

The job queue on which the job is placed is specified on the JOBQ parameter on the BCHJOB command, on the start reader command, or in the job description. If the JOBQ parameter on the BCHJOB command is:

- *RDR: The job queue is selected from the JOBQ parameter on the start reader command.
- *JOBD: The job queue is selected from the JOBQ parameter in the job description.
- A specific job queue: The specified queue is used.

For jobs with small input streams, you may improve system performance by not using input spooling. The submit job commands (SBMDBJOB and SBMDKTJOB) read the input stream and place the job on the job queue in the appropriate subsystem, bypassing the spooling subsystem and reader operations.

If your job requires a large input stream to be read, you should use input spooling (STRDKTRDR or STRDBRDR command) to allow the job to be input independent of when the job is actually processed.

Summary of Job Input Commands

The following commands may be used when submitting jobs to the system. The start reader commands may be used for spooling job input; the submit job commands do not use spooling. For detailed descriptions of these commands, see the *CL Reference*.

BCHJOB
: Batch Job: Marks the start of a job in a batch input stream and defines the operating characteristics of the job.

DATA
: Data: Marks the start of an inline data file.

ENDBCHJOB
: End Batch Job: Marks the end of a job in a batch input stream.

ENDINP
: End Input: Marks the end of the batch input stream.

SBMDBJOB
: Submit Database Jobs: Reads an input stream from a database file and places the jobs in the input stream on the appropriate job queues.

SBMDKTJOB
: Submit Diskette Jobs: Reads an input stream from diskette and places the jobs in the input stream on the appropriate job queues.

STRDBRDR
: Start Database Reader: Starts a reader to read an input stream from a database file and places the job in the input stream on the appropriate job queue.

STRDKTRDR
: Start Diskette Reader: Starts a reader to read an input stream from diskette and places the job in the input stream on the appropriate job queue.

Job Queues

A job queue is an ordered list of jobs waiting to be processed by a particular subsystem. Jobs will not be selected from a job queue by a subsystem unless the subsystem is active and the job queue is not held. You can use job queues to control the order in which jobs are run.

A base set of job queues is provided with your system. In addition, you may create additional job queues that you need.

IBM-Supplied Job Queues: Several job queues are provided by IBM when your system is shipped. IBM supplies job queues for each IBM-supplied subsystem.

QCTL	Controlling subsystem queue
QBASE	QBASE subsystem job queue
QBATCH	Batch subsystem queue
QINTER	Interactive subsystem queue
QPGMR	Programmer subsystem queue
QSPL	Spooling subsystem queue
QSYSSBSD	QSYSSBSD subsystem job queue
QS36MRT	QS36MRT job queue
QS36EVOKE	QS36EVOKE job queue
QFNC	Finance subsystem job queue
QSNADS	QSNADS subsystem job queue

Using Multiple Job Queues: In many cases, using QBATCH as the only job queue with the default of one active job will be adequate for your needs. If this is not adequate, you may want to have multiple job queues so that some job queues are active during normal working hours, some are for special purposes, and some are active after normal working hours. For example, you could designate different job queues for:

- Long-running jobs so you can control how many jobs are active at the same time.

  You may also want these jobs to use a lower priority than the other batch jobs.
- Overnight jobs that are inconvenient to run during normal working hours.

  For example, to run a Reorganize Physical File Member (RGZPFM) command on a large database file requires an exclusive lock on the file. This means that other users cannot access the file while this operation is taking place. Additionally, this operation could take a long time. It would be more efficient to place this job on a job queue for jobs which run during off-shift hours.
- High-priority jobs.

  You may want to have a job queue to which all high-priority work is sent. You could then ensure that this work is completed rapidly and is not delayed by lower-priority jobs.
- Jobs that are directed to particular resource requirement such as diskette or tape.

  Such a job queue would need a MAXACT parameter of 1 in the job queue entry of the subsystem description so that only one job at a time uses the resource.

  For example, if a tape is used for several jobs, all jobs using tape would be placed on a single job queue. One job at a time would then be selected from the job queue. This would ensure that no two jobs compete for the same device at the same time. If this happened, it would cause one of the jobs to end with an allocation error.

  Note: Tape output cannot be spooled.
- Programmer work.

  You may want to have a job queue to handle programmer work or types of work that could be held while production work is being run.
- Sequential running of a series of jobs.

  You may have an application in which one job is dependent on the completion of another job. If you place these jobs on a job queue that selects and runs one job at a time, this would ensure the running sequence of these jobs.

  If a job requires exclusive control of a file, you may want to place it on a job queue when the queue is the only one active on the system, such as during the night or on a weekend.

If you use multiple job queues, you will find that control of the various job queues is a main consideration. You will usually want to control:

- How many job queues exist.
- How many job queues are active in a particular subsystem at the same time.
- How many active jobs can be selected from a particular job queue at a particular time.
- How many jobs can be active in a subsystem at a particular time.

Creating Your Own Job Queues: There are numerous reasons why you may decide that you need job queues in addition to the ones supplied by IBM. Additional job queues can be created by using the Create Job Queue (CRTJOBQ) command:

```
CRTJOBQ QGPL/QNIGHT TEXT('Job queue for +
  night-time jobs')
```

The following lists the parameters on the Create Job Queue (CRTJOBQ) command and what they specify:

- OPRCTL: Specifies whether a user having job control authority can control the job queue (for example, if the user can hold the job queue).
- AUTCHK: Specifies what type of authority to the job queue will enable a user to control the jobs on the job queue (for example, enable the user to hold the jobs on the job queue).
- AUT: Specifies what control users have over the job queue itself.
- TEXT: Up to 50 characters of text that describe the job queue.

Multiple Job Queues for a Subsystem: If the priority and sequence of the next job queue to be used is important, you may want to assign and control multiple job queues for each subsystem. One use of multiple job queues is to establish a high-priority and a normal-priority job queue within a subsystem, allowing only one active job on each queue at any time.

Another example: If your production batch jobs need to be completed before a special after-hours job queue can be made active, you could have the last job in the normal batch job queue release the after-hours job queue.

Refer to the SEQNBR parameter in the Add Job Queue Entry (ADDJOBQE) command in the *CL Reference* manual to determine how to set priorities for jobs on job queues. For more information, refer to the *Work Management Guide*.

Using the WRKJOBQ Command: Jobs already on the job queue can be controlled using the Work with Job Queue (WRKJOBQ) command.

The WRKJOBQ command lists either:

- All the job queues on the system
- All the jobs on a specific job queue

The ability to list all the job queues is important when you are not sure what job queue was used for a job. From the list of all job queues, you can look at each job queue to find the job. The display of a specific job queue provides a list of all the jobs on the queue in the order in which they will become active.

Transferring Jobs

If a job is on a job queue and is not yet active, you can change the job to a different job queue using the JOBQ parameter on the Change Job (CHGJOB) command.

If a job becomes active, it is possible to place it back on a job queue. See the *Work Management Guide* for a discussion of the Transfer Job (TFRJOB) and Transfer Batch Job (TFRBCHJOB) commands.

Job Queue Security: You can maintain a level of security with your job queue by authorizing only certain persons (user profiles) to that job queue. In general, there are three ways that a user can become authorized to control a job queue (for example, hold or release the job queue):

- User is assigned spool control authority (SPCAUT(*SPLCTL)) in the user's user profile.
- User is assigned job control authority (SPCAUT(*JOBCTL)) in the user's user profile and the job queue can be controlled by the operator (OPRCTL(*YES)).
- User has the required object authority to the job queue. The required object authority is specified by the AUTCHK parameter on the CRTJOBQ command. A value of *OWNER indicates that only the owner of the job queue is authorized via the object authority for the job queue. A value of *DTAAUT indicates that users with *CHANGE authority for the job queue are authorized to control the job queue.

  Note: The specific authority required for *DTAAUT are *READ, *ADD, and *DLT data authority.

See the *CL Reference* manual for more information about authority requirements for individual commands.

These three methods of authorization apply only to the job queue, not to the jobs on the job queue. The normal authority rules for controlling jobs apply whether the job is on a job queue or whether it is currently running. See the *Work Management Guide* for details on the authority rules for jobs.

Job Queue Recovery: If a command fails or the system stops abnormally while a reader or a submit jobs command is running and a partial job (not all the input stream has been read) is placed on the queue, the entire job must be resubmitted to the job queue.

If a job is on a job queue when the system stops abnormally without damaging that job queue, the job remains intact on the job queue and is ready to run when the system becomes active again.

If the system stops abnormally while a job is running, the job is lost and must be resubmitted to the job queue.

If a job queue becomes damaged such that it cannot be used, you will be notified by a message sent to the system operator message queue. The message will come from a system function when a reader, Submit Jobs command, or a job tries to put or take jobs from the damaged queue.

A damaged job queue can be deleted using the Delete Job Queue (DLTJOBQ) command, or it will be deleted by the system during the next IPL. After a damaged job queue is deleted, all job files on the damaged job queue will be moved to output queue QSPRCLJOBQ in library QRCL. This is done by the QSPLMAINT system job, which issues completion message CPC3308 to the QSYSOPR message queue when all jobs have been moved to the QSPRCLJOBQ output queue.

After the damaged job queue is deleted, it can be created again by entering the Create Job Queue (CRTJOBQ) command. Jobs on the job queue QSPRCLOUTQ can be moved back to the newly created output queue using the Change Job (CHGJOB) command.

Using an Inline Data File

An inline data file is a data file that is included as part of a batch job when the job is read by a reader or a submit jobs command. An inline data file is delimited in the job by a //DATA command at the start of the file and by an end-of-data delimiter at the end of the file. The end-of-data delimiter can be a user-defined character string or the default of //.

The // must appear in positions 1 and 2. If your data contains a // in positions 1 and 2, you should use a unique set of characters such as:

```
// *** END OF DATA
```

To specify this as a unique end-of-data delimiter, the ENDCHAR parameter on the //DATA command should be coded as:

```
ENDCHAR('// *** END OF DATA')
```

Note: Inline data files can be accessed only during the first routing step of a batch job. If a batch job contains a Transfer Job (TFRJOB), a Reroute Job (RRTJOB), or a Transfer Batch Job (TFRBCHJOB) command, the inline data files cannot be accessed in the new routing step.

An inline data file can be either named or unnamed. For an unnamed inline data file, either QINLINE is specified as the file name in the //DATA command or no name is specified. For a named inline data file, a file name is specified.

A named inline data file has the following characteristics:

- It has a unique name in a job; no other inline data file can have the same name.
- It can be used more than once in a job.
- Each time it is opened, it is positioned to the first record.

To use a named inline data file, you must either specify the file name in the program or use an override command to change the file name specified in the program to the name of the inline data file. The file must be opened for input only.

An unnamed inline data file has the following characteristics:

- Its name is QINLINE. (In a batch job, all unnamed inline data files are given the same name.)
- It can only be used once in a job.
- When more than one unnamed inline data file is included in a job, the files must be in the input stream in the same order as when the files are opened.

To use an unnamed inline data file, do one of the following:

- Specify QINLINE in the program.
- Use an override file command to change the file name specified in the program to QINLINE.

If your high-level language requires unique file names within one program, you can use QINLINE as a file name only once. If you need to use more than one unnamed inline data file, you can use an override file command in the program to specify QINLINE for additional unnamed inline data files.

Note: If you run commands conditionally and process more than one unnamed inline data file, the results cannot be predicted if the wrong unnamed inline data file is used.

Open Considerations for Inline Data Files: The following considerations apply to opening inline data files:

- Record length specifies the length of the input records. (Record length is optional.) When the record length exceeds the length of the data, a message is sent to your program. The data is padded with blanks. When the record length is less than the data length, the records are truncated.
- When a file is specified in a program, the system searches for the file as a named inline data file before it searches for the file in a library. Therefore, if a named inline data file has the same name as a file that is not an inline data file, the inline data file is always used, even if the file name is qualified by a library name.
- Named inline data files *can* be shared between programs in the same job by specifying SHARE(*YES) on a create file or override file command.

  For example, if an override file command specifying a file named INPUT and SHARE(*YES) is in a batch job with an inline data file named INPUT, any programs running in the job that specify the file name INPUT will share the same named inline data file.

  Unnamed inline data files *cannot* be shared between programs in the same job.
- When you use inline data files, you should make sure the correct file type is specified on the //DATA command. For example, if the file is to be used as a source file, the file type on the //DATA command must be source.
- Inline data files must be opened for input only.

Spooling Subsystem

The spooling subsystem, QSPL, is used for processing the spooling readers and writers. The subsystem needs to be active when readers or writers are active. The spooling subsystem and the individual readers and writers can be controlled from jobs that run in other subsystems.

The start reader and start writer commands submit jobs to the job queue of the spooling subsystem. Requests for reader or writer jobs are placed on the QSPL job queue, and the next entry on the QSPL job queue is selected to run if:

- The number of active jobs is less than the QSPL subsystem attribute of MAXJOBS.
- The number of active jobs from the QSPL job queue is less than the MAXACT attribute for the job queue.

Work management associated with the QSPL subsystem is similar to that for other subsystems as described in the *Work Management Guide.* To control the storage used on your system see "Spooling Library."

Spooling Library

The spooling library (QSPL) contains database files that are used to store data for inline data files and spooled files. Each file in library QSPL can have several members. Each member contains all the data for an inline data file or spooled file.

When the spooled file is printed or deleted, its associated database member in the spooling library is cleared of records, but not removed, so that it can be used for another inline data file or spooled file. If no database members are available in library QSPL, then a member is automatically created.

Printing a spooled file or clearing an output queue does not reduce the number of associated database members. If an excessive number of associated database members were created on your system (for example, if a program went into a loop and created thousands of spooled files), the spool database members use storage on the system even if you clear the output queue.

Because the system keeps the date and time whenever a database member becomes available (for example, clearing of records after the spooled file has been printed or deleted), you can remove these spooled database members in the following ways:

- QRCLSPLSTG system value

  When this system value is set, the system removes spool database members that have been available for more than the number of days specified by the system value. The default value is 8 days. Values that can be set for this system value are:

- 1-366: Valid range of day values that can be set. When an available member is older than the set number of days, it is removed by the system.
- *NOMAX: Available spool database members are never automatically removed. The user must use the Reclaim Spool Storage (RCLSPLSTG) command to remove these members.
- *NONE: The database member is removed as soon as the spooled file is printed or deleted.

  Note: If *NONE is specified, you will never have available database members in QSPL. If there are no available members when subsequent inline data files or spooled files are created, the system creates members and allocates storage to be used. This slows down the jobs that are creating inline data files or spooled files. It is highly recommended that the system value never be set to *NONE.

- RCLSPLSTG command

  Removes available database members that have been cleared of records for more than the number of days specified on the command. The command will run until it completes in the user's process.

The procedures previously described are the only allowable ways to remove spooled files from the QSPL library. Any other way can cause severe problems. It is best to keep the QSPL library small by periodically deleting old spooled files with the DLTSPLF or CLROUTQ commands. This procedure allows database members to be used again, rather than having to increase the size of the spooling library to accommodate new database members.

Displaying the data in the QSPL library may also prevent the data from being cleared, wasting storage space. Any command or program used to look at a database file in the QSPL library must allocate the database file and member; if a writer tries to remove an allocated member after printing is completed, it will not be able to clear the member. Because the member is not cleared, it cannot be used for another inline data file or spooled file and it will not be removed by setting the QRCLSPLSTG system value or running the RCLSPLSTG command.

Saving a database file in the QSPL library can cause more problems than displaying the data in one member of the file because all members will be allocated a much longer time when a database file is saved. Because restoring these files destroys present and future spooled file data, there is no reason to save one of these files.

The QSPL library type and authority should not be changed. The authority to the files within QSPL should also not be changed. The QSPL library and the files in it are created in a particular way so that system spooling functions can access them. Changing the library or files could cause some system spooling functions to work incorrectly.

Appendix A. Feedback Area Layouts

This appendix contains Product-Sensitive Programming Interface and Associated Guidance Information.

Tables in this section describe the open and I/O feedback areas associated with any opened file. The following information is presented for each item in these feedback areas:

- Offset, which is the number of bytes from the start of the feedback area to the location of each item.
- Data Type.
- Length, which is given in number of bytes.
- Contents, which is the description of the item and the valid values for it.
- File type, which is an indication of what file types each item is valid for.

The support provided by the high-level language you are using determines how to access this information and how the data types are represented. See your high-level language manual for more information.

Open Feedback Area

The open feedback area is the part of the open data path (ODP) that contains general information about the file after it has been opened. It also contains file-specific information, depending on the file type, plus information about each device or communications session defined for the file. This information is set during open processing and may be updated as other operations are performed.

Table A-1 (Page 1 of 6). Open Feedback Area

Offset	Data Type	Length	Contents	File Type
0	Character	2	Open data path (ODP) type: DS Display, tape, ICF, save, printer file not being spooled, or diskette file not being spooled. DB Database member. SP Printer or diskette file being spooled or inline data file.	All
2	Character	10	Name of the file being opened. If the ODP type is DS, this is the name of the device file or save file. If the ODP type is SP, this is the name of the device file or the inline data file. If the ODP type is DB, this is the name of the database file that the member belongs to.	All
12	Character	10	Name of the library containing the file. For an inline data file, the value is *N.	All
22	Character	10	Name of the spooled file. The name of a database file containing the spooled input or output records.	Printer or diskette being spooled or inline data
32	Character	10	Name of the library in which the spooled file is located.	Printer or diskette being spooled or inline data
42	Binary	2	Spooled file number.	Printer or diskette being spooled
44	Binary	2	Maximum record length.	All
46	Binary	2	Maximum key length.	Database

Table A-1 (Page 2 of 6). Open Feedback Area

Offset	Data Type	Length	Contents	File Type
48	Character	10	Member name: • If ODP type DB, the member name in the file named at offset 2. If file is overridden to MBR(*ALL), the member name that supplied the last record. • If ODP type SP, the member name in the file named at offset 22.	Database, printer, diskette, and inline data
58	Binary	4	Reserved.	
62	Binary	4	Reserved.	
66	Binary	2	File type: 1 Display 2 Printer 4 Diskette 5 Tape 9 Save 10 DDM 11 ICF 20 Inline data 21 Database	All
68	Character	3	Reserved.	
71	Binary	2	Number of lines on a display screen or number of lines on a printed page.	Display, printer
			Length of the null field byte map.	Database
73	Binary	2	Number of positions on a display screen or number of characters on a printed line.	Display, printer
			Length of the null key field byte map.	Database
75	Binary	4	Number of records in the member at open time. For a join logical file, the number of records in the primary. Supplied only if the file is being opened for input.	Database, inline data
79	Character	2	Access type: AR Arrival sequence. KC Keyed with duplicate keys allowed. Duplicate keys are accessed in first-changed-first-out (FCFO) order. KF Keyed with duplicate keys allowed. Duplicate keys are accessed in first-in-first-out (FIFO) order. KL Keyed with duplicate keys allowed. Duplicate keys are accessed in last-in-first-out (LIFO) order. KN Keyed with duplicate keys allowed. The order in which duplicate keys are accessed can be one of the following: • First-in-first-out (FIFO) • Last-in-first-out (LIFO) • First-changed-first-out (FCFO) KU Keyed, unique.	Database

Table A-1 (Page 3 of 6). Open Feedback Area

Offset	Data Type	Length	Contents	File Type
81	Character	1	Duplicate key indication. Set only if the access path is KC, KF, KL, KN, or KU: D — Duplicate keys allowed if the access path is KF or KL. U — Duplicate keys are not allowed; all keys are unique and the access path is KU.	Database
82	Character	1	Source file indication. Y — File is a source file. N — File is not a source file.	Database, tape, diskette, and inline data
83	Character	10	Reserved.	
93	Character	10	Reserved.	
103	Binary	2	Offset to volume label fields of open feedback area.	Diskette, tape
105	Binary	2	Maximum number of records that can be read or written in a block when using blocked record I/O.	All
107	Binary	2	Overflow line number.	Printer
109	Binary	2	Blocked record I/O record increment. Number of bytes that must be added to the start of each record in a block to address the next record in the block.	All
111	Binary	4	Reserved.	
115	Character	1	Miscellaneous flags. Bit 1: Reserved.	
			Bit 2: File shareable 0 File was not opened shareable. 1 File was opened shareable (SHARE(*YES)).	All
			Bit 3: Commitment control 0 File is not under commitment control. 1 File is under commitment control.	Database
			Bit 4: Commitment lock level 0 Only changed records are locked (LCKLVL (*CHG)). If this bit is zero and bit 8 of the character at offset 132 is one, then all records accessed are locked, but the locks are released when the current position in the file changes (LCKLVL (*CS)). 1 All records accessed are locked (LCKLVL (*ALL)).	Database
			Bit 5: Member type 0 Member is a physical file member. 1 Member is a logical file member.	Database

Table A-1 (Page 4 of 6). Open Feedback Area

Offset	Data Type	Length	Contents	File Type
			Bit 6: Field-level descriptions 0 File does not contain field-level descriptions. 1 File contains field-level descriptions.	All, except database
			Bit 7: DBCS or graphic-capable file 0 File does not contain DBCS or graphic-capable fields. 1 File does contain DBCS or graphic-capable fields.	Database, display, printer, tape, diskette, and ICF
			Bit 8: End-of-file delay 0 End-of-file delay processing is not being done. 1 End-of-file delay processing is being done.	Database
116	Character	10	Name of the requester device. For display files, this is the name of the display device description that is the requester device. For ICF files, this is the program device name associated with the remote location of *REQUESTER. This field is supplied only when either a device or remote location name of *REQUESTER is being attached to the file by an open or acquire operation. Otherwise, this field contains *N.	Display, ICF
126	Binary	2	File open count. If the file has not been opened shareable, this field contains a 1. If the file has been opened shareable, this field contains the number of programs currently attached to this file.	All
128	Binary	2	Reserved.	
130	Binary	2	Number of based-on physical members opened. For logical members, this is the number of physical members over which the logical member was opened. For physical members, this field is always set to 1.	Database
132	Character	1	Miscellaneous flags.	
			Bit 1: Multiple member processing 0 Only the member specified will be processed. 1 All members will be processed.	Database
			Bit 2: Join logical file 0 File is not a join logical file. 1 File is a join logical file.	Database
			Bit 3: Local or remote data 0 Data is stored on local system. 1 Data is stored on remote system.	Database

Table A-1 (Page 5 of 6). Open Feedback Area

Offset	Data Type	Length	Contents	File Type
			Bit 4: Remote System/38 or AS/400 data. Applicable only if the value of Bit 3 is 1. 0 Data is on a remote System/38 or AS/400 system. 1 Data is not on a remote System/38 or AS/400 system.	Database
			Bit 5: Separate indicator area 0 Indicators are in the I/O buffer of the program. 1 Indicators are not in the I/O buffer of the program. The DDS keyword, INDARA, was used when the file was created.	Printer, display, and ICF
			Bit 6: User buffers 0 System creates I/O buffers for the program. 1 User program supplies I/O buffers.	All
			Bit 7: Reserved.	
			Bit 8: Additional commitment lock level indicator. This is only valid if bit 3 of the character at offset 115 is one. If bit 4 of the character at offset 115 is zero: 0 Only changed records are locked (LCKLVL(*CHG)). 1 All records accessed are locked, but the locks are released when the current position in the file changes (LCKLVL(*CS)). If bit 4 of the character at offset 115 is one: 0 All records accessed are locked (LCKLVL(*ALL)). 1 Reserved.	Database
133	Character	2	Open identifier. The value is unique for a full (non-shared) open operation of a file. This is used for display and ICF files, but is set up for all file types. It allows you to match this file to an entry on the associated data queue.	All
135	Binary	2	The field value is the maximum record format length, including both data and file-specific information such as: first-character forms control, option indicators, response indicators, source sequence numbers, and program-to-system data. If the value is zero, then use the field at offset 44.	Printer, diskette, tape, and ICF
137	Binary	2	Coded character set identifier (CCSID) of the character data in the buffer.	Database

Table A-1 (Page 6 of 6). Open Feedback Area

Offset	Data Type	Length	Contents	File Type
139	Character	1	Miscellaneous flags.	Database
			Bit 1: Null-capable field file. 0 File does not contain null-capable fields. 1 File contains null-capable fields.	
			Bit 2: Variable length fields file. 0 File does not contain any variable length fields. 1 File contains variable length fields.	Database
			Bit 3: Variable length record processing 0 Variable length record processing will not be done. 1 Variable length record processing will be done.	Database
			Bit 4: CCSID character substitution 0 No substitution characters will be used during CCSID data conversion. 1 Substitution characters may be used during CCSID data conversion.	Database, Display
			Bits 5-8: Reserved.	
140	Character	6	Reserved.	
146	Binary	2	Number of devices defined for this ODP. For displays, this is determined by the number of devices defined on the DEV parameter of the Create Display File (CRTDSPF) command. For ICF, this is determined by the number of program devices defined or acquired with the Add ICF Device Entry (ADDICFDEVE) or the Override ICF Device Entry (OVRICFDEVE) command. For all other files, it has the value of 1.	All
148	Character		Device name definition list. See "Device Definition List" on page A-7 for a description of this array.	All

Device Definition List

The device definition list part of the open feedback area is an array structure. Each entry in the array contains information about each device or communications session attached to the file. The number of entries in this array is determined by the number at offset 146 of the open feedback area. The device definition list begins at offset 148 of the open feedback area. The offsets shown for it are from the start of the device definition list rather than the start of the open feedback area.

Table A-2 (Page 1 of 4). Device Definition List

Offset	Data Type	Length	Contents	File Type
0	Character	10	Program device name. For database files, the value is DATABASE. For printer or diskette files being spooled, the value is *N. For save files, the value is *NONE. For ICF files, the value is the name of the program device from the ADDICFDEVE or OVRICFDEVE command. For all other files, the value is the name of the device description.	All, except inline data
10	Character	50	Reserved.	
60	Character	10	Device description name. For printer or diskette files being spooled, the value is *N. For save files, the value is *NONE. For all other files, the value is the name of the device description.	All, except database and inline data
70	Character	1	Device class. hex 01 Display hex 02 Printer hex 04 Diskette hex 05 Tape hex 09 Save hex 0B ICF	All, except database and inline data
71	Character	1	Device type. hex 02 5256 Printer hex 07 5251 Display Station hex 08 Spooled hex 0A BSCEL hex 0B 5291 Display Station hex 0C 5224/5225 printers hex 0D 5292 Display Station hex 0E APPC hex 0F 5219 Printer hex 10 5583 Printer (DBCS) hex 11 5553 Printer hex 12 5555-B01 Display Station hex 13 3270 Display Station hex 14 3270 Printer hex 15 Graphic-capable device hex 16 Financial Display Station hex 17 3180 Display Station	

Table A-2 (Page 2 of 4). Device Definition List

Offset	Data Type	Length	Contents		File Type
			hex 18	Save file	
			hex 19	3277 DHCF Device	
			hex 1A	9347 Tape Unit	
			hex 1B	9348 Tape Unit	
			hex 1C	9331-1 Diskette Unit	
			hex 1D	9331-2 Diskette Unit	
			hex 1E	Intrasystem communications support	
			hex 1F	Asynchronous communications support	
			hex 20	SNUF	
			hex 21	4234 (SCS) Printer	
			hex 22	3812 (SCS) Printer	
			hex 23	4214 Printer	
			hex 24	4224 (IPDS*) Printer	
			hex 25	4245 Printer	
			hex 26	3179-2 Display Station	
			hex 27	3196-A Display Station	
			hex 28	3196-B Display Station	
			hex 29	5262 Printer	
			hex 2A	6346 Tape Unit	
			hex 2B	2440 Tape Unit	
			hex 2C	9346 Tape Unit	
			hex 2D	6331 Diskette Unit	
			hex 2E	6332 Diskette Unit	
			hex 30	3812 (IPDS) Printer	
			hex 31	4234 (IPDS) Printer	
			hex 32	IPDS printer, model unknown	
			hex 33	3197-C1 Display Station	
			hex 34	3197-C2 Display Station	
			hex 35	3197-D1 Display Station	
			hex 36	3197-D2 Display Station	
			hex 37	3197-W1 Display Station	
			hex 38	3197-W2 Display Station	
			hex 39	5555-E01 Display Station	
			hex 3A	3430 Tape Unit	
			hex 3B	3422 Tape Unit	
			hex 3C	3480 Tape Unit	
			hex 3D	3490 Tape Unit	
			hex 3E	3476-EA Display Station	
			hex 3F	3477-FG Display Station	
			hex 40	3278 DHCF device	
			hex 41	3279 DHCF device	
			hex 42	ICF finance device	
			hex 43	Retail communications device	
			hex 44	3477-FA Display Station	
			hex 45	3477-FC Display Station	
			hex 46	3477-FD Display Station	
			hex 47	3477-FW Display Station	
			hex 48	3477-FE Display Station	
			hex 49	6367 Tape Unit	
			hex 4A	6347 Tape Unit	

Table A-2 (Page 3 of 4). Device Definition List

Offset	Data Type	Length	Contents		File Type
			hex 4D	Network Virtual Terminal Display Station	
			hex 4E	6341 Tape Unit	
			hex 4F	6342 Tape Unit	
			hex 50	6133 Diskette Unit	
			hex 51	5555-C01 Display Station	
			hex 52	5555-F01 Display Station	
			hex 53	6366 Tape Unit	
			hex 54	7208 Tape Unit	
			hex 55	6252 (SCS) Printer	
			hex 56	3476-EC Display Station	
			hex 57	4230 (IPDS) Printer	
			hex 58	5555-G01 Display Station	
			hex 59	5555-G02 Display Station	
			hex 5A	6343 Tape Unit	
			hex 5B	6348 Tape Unit	
			hex 5C	6368 Tape Unit	
			hex 5D	3486-BA Display Station	
			hex 5F	3487-HA Display Station	
			hex 60	3487-HG Display Station	
			hex 61	3487-HW Display Station	
			hex 62	3487-HC Display Station	
72	Binary	2	Number of lines on the display screen.		Display
74	Binary	2	Number of positions in each line of the display screen.		Display
76	Character	2	Bit flags.		Display
			Bit 1:	Blinking capability. 0 Display is not capable of blinking. 1 Display is capable of blinking.	
			Bit 2:	Device location. 0 Local device. 1 Remote device.	Display
			Bit 3:	Acquire status. This bit is set even if the device is implicitly acquired at open time. 0 Device is not acquired. 1 Device is acquired.	Display, ICF
			Bit 4:	Invite status. 0 Device is not invited. 1 Device is invited.	Display, ICF
			Bit 5:	Data available status (only if device is invited). 0 Data is not available. 1 Data is available.	Display, ICF

Table A-2 (Page 4 of 4). Device Definition List

Offset	Data Type	Length	Contents	File Type
			Bit 6: Transaction status.	ICF
			0 Transaction is not started. An evoke request has not been sent, a detach request has been sent or received, or the transaction has completed.	
			1 Transaction is started. The transaction is active. An evoke request has been sent or received and the transaction has not ended.	
			Bit 7: Requester device.	Display, ICF
			0 Not a requester device.	
			1 A requester device.	
			Bit 8: DBCS device.	Display
			0 Device is not capable of processing double-byte data.	
			1 Device is capable of processing double-byte data.	
			Bits 9-10: Reserved.	
			Bit 11: DBCS keyboard.	Display
			0 Keyboard is not capable of entering double-byte data.	
			1 Keyboard is capable of entering double-byte data.	
			Bits 12-16: Reserved.	
78	Character	1	Synchronization level.	ICF
			hex 00 The transaction was built with SYNLVL(*NONE). Confirm processing is not allowed.	
			hex 01 The transaction was built with SYNLVL(*CONFIRM). Confirm processing is allowed.	
79	Character	1	Conversation type.	ICF
			hex D0 Basic conversation (CNVTYPE(*USER)).	
			hex D1 Mapped conversation (CNVTYPE(*SYS)).	
80	Character	50	Reserved.	

Volume Label Fields

Table A-3. Volume Label Fields

Offset	Data Type	Length	Contents	File Type
0	Character	128	Volume label of current volume.	Diskette, tape
128	Character	128	Header label 1 of the opened file.	Diskette, tape
256	Character	128	Header label 2 of the opened file.	Tape

I/O Feedback Area

The results of I/O operations are communicated to the program using OS/400 messages and I/O feedback information. The I/O feedback area is updated for every I/O operation unless your program is using blocked record I/O. In that case, the feedback area is updated only when a block of records is read or written. Some of the information reflects the last record in the block. Other information, such as the count of I/O operations, reflects the number of operations on blocks of records and not the number of records. See your high-level language manual to determine if your program uses blocked record I/O.

The I/O feedback area consists of two parts: a common area and a file-dependent area. The file-dependent area varies by the file type.

Common I/O Feedback Area

Table A-4 (Page 1 of 4). Common I/O Feedback Area

Offset	Data Type	Length	Contents
0	Binary	2	Offset to file-dependent feedback area.
2	Binary	4	Write operation count. Updated only when a write operation completes successfully. For blocked record I/O operations, this count is the number of blocks, not the number of records.
6	Binary	4	Read operation count. Updated only when a read operation completes successfully. For blocked record I/O operations, this count is the number of blocks, not the number of records.
10	Binary	4	Write-read operation count. Updated only when a write-read operation completes successfully.
14	Binary	4	Other operation count. Number of successful operations other than write, read, or write-read. Updated only when the operation completes successfully. This count includes update, delete, force-end-of-data, force-end-of-volume, change-end-of-data, release record lock, and acquire/release device operations.
18	Character	1	Reserved.
19	Character	1	Current operation. hex 01 Read or read block or read from invited devices hex 02 Read direct hex 03 Read by key hex 05 Write or write block hex 06 Write-read hex 07 Update hex 08 Delete hex 09 Force-end-of-data hex 0A Force-end-of-volume hex 0D Release record lock hex 0E Change end-of-data hex 11 Release device hex 12 Acquire device

Table A-4 (Page 2 of 4). Common I/O Feedback Area

Offset	Data Type	Length	Contents
20	Character	10	Name of the record format just processed, which is either: • Specified on the I/O request, or • Determined by default or format selection processing For display files, the default name is either the name of the only record format in the file or the previous record format name for the record written to the display that contains input-capable fields. Because a display file may have multiple formats on the display at the same time, this format may not represent the format where the last cursor position was typed. For ICF files, the format name is determined by the system, based on the format selection option used. Refer to the *ICF Programmer's Guide* for more information.
30	Character	2	Device class: Byte 1: hex 00 Database hex 01 Display hex 02 Printer hex 04 Diskette hex 05 Tape hex 09 Save hex 0B ICF Byte 2 (if byte 1 contains hex 00): hex 00 Nonkeyed file hex 01 Keyed file Byte 2 (if byte 1 does not contain hex 00): hex 02 5256 Printer hex 07 5251 Display Station hex 08 Spooled hex 0A BSCEL hex 0B 5291 Display Station hex 0C 5224/5225 printers hex 0D 5292 Display Station hex 0E APPC hex 0F 5219 Printer hex 10 5583 Printer (DBCS) hex 11 5553 Printer hex 12 5555-B01 Display Station hex 13 3270 Display Station hex 14 3270 Printer hex 15 Graphic-capable device hex 16 Financial Display Station hex 17 3180 Display Station hex 18 Save file hex 19 3277 DHCF device hex 1A 9347 Tape Unit hex 1B 9348 Tape Unit hex 1C 9331-1 Diskette Unit

Table A-4 (Page 3 of 4). Common I/O Feedback Area

Offset	Data Type	Length	Contents	
			hex 1D	9331-2 Diskette Unit
			hex 1E	Intrasystem communications support
			hex 1F	Asynchronous communications support
			hex 20	SNUF
			hex 21	4234 (SCS) Printer
			hex 22	3812 (SCS) Printer
			hex 23	4214 Printer
			hex 24	4224 (IPDS) Printer
			hex 25	4245 Printer
			hex 26	3179-2 Display Station
			hex 27	3196-A Display Station
			hex 28	3196-B Display Station
			hex 29	5262 Printer
			hex 2A	6346 Tape Unit
			hex 2B	2440 Tape Unit
			hex 2C	9346 Tape Unit
			hex 2D	6331 Diskette Unit
			hex 2E	6332 Diskette Unit
			hex 30	3812 (IPDS) Printer
			hex 31	4234 (IPDS) Printer
			hex 32	IPDS printer, model unknown
			hex 33	3197-C1 Display Station
			hex 34	3197-C2 Display Station
			hex 35	3197-D1 Display Station
			hex 36	3197-D2 Display Station
			hex 37	3197-W1 Display Station
			hex 38	3197-W2 Display Station
			hex 39	5555-E01 Display Station
			hex 3A	3430 Tape Unit
			hex 3B	3422 Tape Unit
			hex 3C	3480 Tape Unit
			hex 3D	3490 Tape Unit
			hex 3E	3476-EA Display Station
			hex 3F	3477-FG Display Station
			hex 40	3278 DHCF device
			hex 41	3279 DHCF device
			hex 42	ICF finance device
			hex 43	Retail communications device
			hex 44	3477-FA Display Station
			hex 45	3477-FC Display Station
			hex 46	3477-FD Display Station
			hex 47	3477-FW Display Station
			hex 48	3477-FE Display Station
			hex 49	6367 Tape Unit
			hex 4A	6347 Tape Unit
			hex 4D	Network Virtual Terminal Display Station
			hex 4E	6341 Tape Unit
			hex 4F	6342 Tape Unit
			hex 50	6133 Diskette Unit
			hex 51	5555-C01 Display Station

Table A-4 (Page 4 of 4). Common I/O Feedback Area

Offset	Data Type	Length	Contents
			hex 52 5555-F01 Display Station
			hex 53 6366 Tape Unit
			hex 54 7208 Tape Unit
			hex 55 6252 (SCS) Printer
			hex 56 3476-EC Display Station
			hex 57 4230 (IPDS) Printer
			hex 58 5555-G01 Display Station
			hex 59 5555-G02 Display Station
			hex 5A 6343 Tape Unit
			hex 5B 6348 Tape Unit
			hex 5C 6368 Tape Unit
			hex 5D 3486-BA Display Station
			hex 5F 3487-HA Display Station
			hex 60 3487-HG Display Station
			hex 61 3487-HW Display Station
			hex 62 3487-HC Display Station
32	Character	10	Device name. The name of the device for which the operation just completed. Supplied only for display, printer, tape, diskette, and ICF files. For printer or diskette files being spooled, the value is *N. For ICF files, the value is the program device name. For other files, the value is the device description name.
42	Binary	4	Length of the record processed by the last I/O operation (supplied only for an ICF, display, tape, or database file). On ICF write operations, this is the record length of the data. On ICF read operations, it is the record length of the record associated with the last read operation.
46	Character	80	Reserved.
126	Binary	2	Number of records retrieved on a read request for blocked records or sent on a write or force-end-of-data or force-end-of-volume request for blocked records. Supplied only for database, diskette, and tape files.
128	Binary	2	For output, the field value is the record format length, including first-character forms control, option indicators, source sequence numbers, and program-to-system data. If the value is zero, use the field at offset 42. For input, the field value is the record format length, including response indicators and source sequence numbers. If the value is zero, use the field at offset 42.
130	Character	2	Reserved.
132	Binary	4	Current block count. The number of blocks of the tape data file already written or read. For tape files only.
136	Character	8	Reserved.

I/O Feedback Area for ICF and Display Files

Table A-5 (Page 1 of 3). I/O Feedback Area for ICF and Display Files

Offset	Data Type	Length	Contents	File Type
0	Character	2	Flag bits. Bit 1: Cancel-read indicator. 0 The cancel-read operation did not cancel the read request. 1 The cancel-read operation canceled the read request. Bit 2: Data-returned indicator. 0 The cancel-read operation did not change the contents of the input buffer. 1 The cancel-read operation placed the data from the read-with-no-wait operation into the input buffer. Bit 3: Command key indicator. 0 Conditions for setting this indicator did not occur. 1 The Print, Help, Home, Roll Up, Roll Down, or Clear key was pressed. The key is enabled with a DDS keyword, but without a response indicator specified. Bits 4-16: Reserved.	Display
2	Character	1	Attention indicator byte (AID). This field identifies which function key was pressed. For ICF files, this field will always contain the value hex F1 to imitate the Enter key being pressed on a display device. For display files, this field will contain the 1-byte hexadecimal value returned from the device. **Hex Codes** **Function Keys** hex 31 1 hex 32 2 hex 33 3 hex 34 4 hex 35 5 hex 36 6 hex 37 7 hex 38 8 hex 39 9 hex 3A 10 hex 3B 11 hex 3C 12 hex B1 13 hex B2 14 hex B3 15 hex B4 16 hex B5 17	

Table A-5 (Page 2 of 3). I/O Feedback Area for ICF and Display Files

Offset	Data Type	Length	Contents	File Type
			hex B6 18 hex B7 19 hex B8 20 hex B9 21 hex BA 22 hex BB 23 hex BC 24 hex BD Clear hex F1 Enter/Rec Adv hex F3 Help (not in operator-error mode) hex F4 Roll Down hex F5 Roll Up hex F6 Print hex F8 Record Backspace hex 3F Auto Enter (for Selector Light Pen)	Display, ICF
3	Character	2	Cursor location (line and position). Updated on input operations that are not subfile operations that return data to the program. For example, hex 0102 means line 1, position 2. Line 10, position 33 would be hex 0A21.	Display
5	Binary	4	Actual data length. For an ICF file, see the *ICF Programmer's Guide* for additional information. For a display file, this is the length of the record format processed by the I/O operation.	Display, ICF
9	Binary	2	Relative record number of a subfile record. Updated for a subfile record operation. For input operations, updated only if data is returned to the program. If multiple subfiles are on the display, this offset will contain the relative record number for the last subfile updated.	Display
11	Binary	2	Indicates the lowest subfile relative record number currently displayed in the uppermost subfile display area if the last write operation was done to the subfile control record with SFLDSP specified. Updated for roll up and roll down operations. Reset to 0 on a write operation to another record. Not set for message subfiles.	Display
13	Binary	2	Total number of records in a subfile. Updated on a put-relative operation to any subfile record. The number is set to zero on a write or write-read operation to any subfile control record with the SFLINZ keyword optioned on. If records are put to multiple subfiles on the display, this offset will contain the total number of records for all subfiles assuming that no write or write-read operations were performed to any subfile control record with the SFLINZ keyword optioned on.	Display
15	Character	2	Cursor location (line and position) within active window. Updated on input operations that are not subfile operations that return data to the program. For example, hex 0203 means line 2, position 3 relative to the upper-left corner of the active window.	Display
17	Character	17	Reserved.	

Table A-5 (Page 3 of 3). I/O Feedback Area for ICF and Display Files

Offset	Data Type	Length	Contents	File Type
34	Character	2	Major return code. 00 Operation completed successfully. 02 Input operation completed successfully, but job is being canceled (controlled). 03 Input operation completed successfully, but no data received. 04 Output exception. 08 Device already acquired. 11 Read from invited devices was not successful. 34 Input exception. 80 Permanent system or file error. 81 Permanent session or device error. 82 Acquire or open operation failed. 83 Recoverable session or device error.	Display, ICF
36	Character	2	Minor return code. For the values for a display file, see the *Guide to Programming Displays*. For the values for an ICF file, see the *ICF Programmer's Guide* and the appropriate communications-type programmer's guide.	Display, ICF
38	Character	8	Systems Network Architecture (SNA) sense return code. For some return codes, this field may contain more detailed information about the reason for the error. For a description of the SNA sense codes, see the appropriate SNA manual.	ICF
46	Character	1	Safe indicator: 0 An end-of-text (ETX) control character has not been received. 1 An ETX control character has been received.	ICF
47	Character	1	Reserved.	
48	Character	1	Request Write (RQSWRT) command from remote system/application. 0 RQSWRT not received 1 RQSWRT received	ICF
49	Character	10	Record format name received from the remote system.	ICF
59	Character	4	Reserved.	
63	Character	8	Mode name.	ICF
71	Character	9	Reserved.	

I/O Feedback Area for Printer Files

Table A-6. I/O Feedback Area for Printer Files

Offset	Data Type	Length	Contents
0	Binary	2	Current line number in a page.
2	Binary	4	Current page count.
6	Character	28	Reserved.
34	Character	2	Major return code. 00 Operation completed successfully. 80 Permanent system or file error. 81 Permanent device error. 82 Open operation failed. 83 Recoverable device error occurred.
36	Character	2	Minor return code. For the values for a printer file, refer to the *Guide to Programming for Printing.*

I/O Feedback Area for Database Files

Table A-7 (Page 1 of 2). I/O Feedback Area for Database Files

Offset	Data Type	Length	Contents
0	Binary	4	Size of the database feedback area, including the key and the null key field byte map.
4	Character	4	Bits 1-32: Each bit represents a join logical file in JFILE keyword. 0 JDFTVAL not supplied for file 1 JDFTVAL supplied for file
8	Binary	2	Offset from the beginning of the I/O feedback area for database files to the null key field byte map which follows the key value (which begins at offset 34 in this area).
10	Binary	2	Number of locked records.
12	Binary	2	Maximum number of fields.
14	Binary	4	Offset to the field-mapping error-bit map.
18	Character	1	Current file position indication. Bit 1: Current file position is valid for get-next-key equal operation. 0 File position is not valid. 1 File position is valid. Bits 2-8: Reserved.

Table A-7 (Page 2 of 2). I/O Feedback Area for Database Files

Offset	Data Type	Length	Contents
19	Character	1	Current record deleted indication: Bits 1-2: Reserved. Bit 3: Next message indicator. 0 Next message not end of file. 1 Next message may be end of file. Bit 4: Deleted record indicator. 0 Current file position is at an active record. 1 Current file position is at a deleted record. Bit 5: Write operation key feedback indicator. 0 Key feedback is not provided by last write operation. 1 Key feedback is provided by last write operation. Bit 6: File position changed indicator. Set only for read and positioning I/O operations. Not set for write, update, and delete I/O operations. 0 File position did not change. 1 File position did change. Bit 7: Pending exception indicator. Valid for files open for input only and SEQONLY(*YES N) where N is greater than 1. 0 Pending retrieval error does not exist. 1 Pending retrieval error does exist. Bit 8: Duplicate key indicator. 0 The key of the last read or write operation was not a duplicate key. 1 The key of the last read or write operation was a duplicate key.
20	Binary	2	Number of key fields. Use this offset for binary operations. Use the next offset (offset 21) for character operations. These offsets overlap and provide the same value (there can be no more than 32 key fields, and only the low-order byte of offset 20 is used).
21	Character	1	Number of key fields.
22	Character	4	Reserved.
26	Binary	2	Key length.
28	Binary	2	Data member number.
30	Binary	4	Relative record number in data member.
34	Character	*	Key value.
*	Character	*	Null key field byte map.

Get Attributes

Performing the get attributes operation allows you to obtain certain information about a specific display device or ICF session.

Table A-8 (Page 1 of 5). Get Attributes

Offset	Data Type	Length	Contents	File Type
0	Character	10	Program device name.	Display, ICF
10	Character	10	Device description name. Name of the device description associated with this entry.	Display, ICF
20	Character	10	User ID.	Display, ICF
30	Character	1	Device class: D Display; I ICF; U Unknown	Display, ICF
31	Character	6	Device type: 3179 3179 Display Station; 317902 3179-2 Display Station; 3180 3180 Display Station; 3196A 3196-A1/A2 Display Station; 3196B 3196-B1/B2 Display Station; 3197C1 3197-C1 Display Station; 3197C2 3197-C2 Display Station; 3197D1 3197-D1 Display Station; 3197D2 3197-D2 Display Station; 3197W1 3197-W1 Display Station; 3197W2 3197-W2 Display Station; 3270 3270 Display Station; 3476EA 3476-EA Display Station; 3476EC 3476-EC Display Station; 3477FA 3477-FA Display Station; 3477FC 3477-FC Display Station; 3477FD 3477-FD Display Station; 3477FE 3477-FE Display Station; 3477FG 3477-FG Display Station; 3477FW 3477-FW Display Station; 525111 5251 Display Station; 5291 5291 Display Station; 5292 5292 Display Station; 529202 5292-2 Display Station	

Table A-8 (Page 2 of 5). Get Attributes

Offset	Data Type	Length	Contents		File Type
			5555B1	5555-B01 Display Station	Display, ICF
			5555C1	5555-C01 Display Station	
			5555E1	5555-E01 Display Station	
			5555F1	5555-F01 Display Station	
			5555G1	5555-G01 Display Station	
			5555G2	5555-G02 Display Station	
			DHCF77	3277 DHCF device	
			DHCF78	3278 DHCF device	
			DHCF79	3279 DHCF device	
			3486BA	3486-BA Display Station	
			3487HA	3487-HA Display Station	
			3487HC	3487-HC Display Station	
			3487HG	3487-HG Display Station	
			3487HW	3487-HW Display Station	
			APPC	Advance program-to-program communications device	
			ASYNC	Asynchronous communications device	
			BSC	Bisynchronous communications device	
			BSCEL	BSCEL communications device	
			FINANC	ICF Finance communications device	
			INTRA	Intrasystem communications device	
			LU1	LU1 communications device	
			RETAIL	RETAIL communications device	
			SNUF	SNA upline facility communications device	
37	Character	1	Requester device. This flag indicates whether this entry is defining a *REQUESTER device.		Display, ICF
			N	Not a *REQUESTER device (communications source device).	
			Y	A *REQUESTER device (communications target device).	
38	Character	1	Acquire status. Set even if device is implicitly acquired at open time.		Display, ICF
			N	Device is not acquired.	
			Y	Device is acquired.	
39	Character	1	Invite status.		Display, ICF
			Y	Device is invited.	
			N	Device is not invited.	
40	Character	1	Data available.		Display, ICF
			Y	Invited data is available.	
			N	Invited data is not available.	
41	Binary	2	Number of rows on display.		Display
43	Binary	2	Number of columns on display.		Display
45	Character	1	Display allow blink.		Display
			Y	Display is capable of blinking.	
			N	Display is not capable of blinking.	

Table A-8 (Page 3 of 5). Get Attributes

Offset	Data Type	Length	Contents	File Type
46	Character	1	Online/offline status. O Display is online. F Display is offline.	Display
47	Character	1	Display location. L Local display. R Remote display.	Display
48	Character	1	Display type. A Alphanumeric or Katakana. I DBCS.	Display
49	Character	1	Keyboard type of display. A Alphanumeric or Katakana keyboard. I DBCS keyboard.	Display
50	Character	1	Transaction status. All communication types. N Transaction is not started. An evoke request has not been sent, a detach request has been sent or received, or the transaction has completed. Y Transaction is started. The transaction is active. An evoke request has been sent or received and the transaction has not ended.	ICF
51	Character	1	Synchronization level. APPC and INTRA. 0 Synchronization level 0 (SYNLVL(*NONE)). 1 Synchronization level 1 (SYNLVL(*CONFIRM)).	ICF
52	Character	1	Conversation being used. APPC only. M Mapped conversation. B Basic conversation.	ICF
53	Character	8	Remote location name. All communication types.	ICF
61	Character	8	Local LU name. APPC only.	ICF
69	Character	8	Local network ID. APPC only.	ICF
77	Character	8	Remote LU name. APPC only.	ICF
85	Character	8	Remote network ID. APPC only.	ICF
93	Character	8	Mode. APPC only.	ICF
101	Character	1	Controller information. Y Display is attached to a controller that supports an enhanced interface for non-programmable work stations. N Display is not attached to a controller that supports an enhanced interface for nonprogrammable work stations.	Display
102	Character	42	Reserved.	Display, ICF

Table A-8 (Page 4 of 5). Get Attributes

Offset	Data Type	Length	Contents	File Type
Note: The following information is provided only for an Integrated Service Digital Network (ISDN) used in the ICF or remote display session. Also, not all of the information will be available if the area to receive it is too small.				
144	Binary	2	ISDN remote number length in bytes. Consists of the total of the lengths of the next three fields: ISDN remote numbering type, ISDN remote numbering plan, and the ISDN remote number. If the ISDN remote number has been padded on the right with blanks, the length of that padding is not included in this total. If ISDN is not used, this field contains 0.	Display, ICF
146	Character	2	ISDN remote numbering type (decimal). 00 Unknown. 01 International. 02 National. 03 Network-specific. 04 Subscriber. 06 Abbreviated.	Display, ICF
148	Character	2	ISDN remote numbering plan (decimal). 00 Unknown. 01 ISDN/Telephony. 03 Data. 04 Telex**. 08 National Standard. 09 Private.	Display, ICF
150	Character	40	The ISDN remote number in EBCDIC, padded on the right with blanks if necessary to fill the field.	Display, ICF
190	Character	4	Reserved.	Display, ICF
194	Binary	2	ISDN remote subaddress length in bytes. Consists of the total of the lengths of the next two fields: ISDN remote subaddress type and the ISDN remote subaddress. If the ISDN remote subaddress has been padded on the right with blanks, the length of that padding is not included in this total. If ISDN is not used, this field contains 0.	Display, ICF
196	Character	2	ISDN remote subaddress type (decimal). 00 NSAP. 01 User-specified.	Display, ICF
198	Character	40	ISDN remote subaddress (EBCDIC representation of the original hexadecimal value, padded on the right with zeros).	Display, ICF
238	Character	1	Reserved.	Display, ICF
239	Character	1	ISDN connection (decimal). 0 Incoming ISDN call. 1 Outgoing ISDN call. Other Non-ISDN connection.	Display, ICF

Table A-8 (Page 5 of 5). Get Attributes

Offset	Data Type	Length	Contents	File Type
240	Binary	2	ISDN remote network address length in bytes. If the ISDN remote network address has been padded on the right with blanks, the length of that padding is not included. If ISDN is not used, this field contains 0.	Display, ICF
242	Character	32	The ISDN remote network address in EBCDIC, padded on the right with blanks, if necessary, to fill the field.	Display, ICF
274	Character	4	Reserved.	Display, ICF
278	Character	2	ISDN remote address extension length in bytes. Consists of the total of the lengths of the next two fields: ISDN remote address extension type and the ISDN remote address extension. If the ISDN remote address extension has been padded on the right with zeros, the length of that padding is not included. If ISDN is not used or there is no ISDN remote address extension, this field contains 0.	Display, ICF
280	Character	1	ISDN remote address extension type (decimal). 0 Address assigned according to ISO 8348/AD2 2 Address not assigned according to ISO 8348/AD2 Other Reserved.	Display, ICF
281	Character	40	ISDN remote address extension (EBCDIC representation of the original hexadecimal value, padded on the right with zeros).	Display, ICF
321	Character	4	Reserved.	Display, ICF
325	Character	1	X.25 call type (decimal). 0 Incoming Switched Virtual Circuit (SVC) 1 Outgoing SVC 2 Not X.25 SVC Other Reserved.	Display, ICF
Note: The following information is available only for when your program was started as a result of a received program start request. Also, not all of the information will be available if the area to receive it is to small.				
326	Character	64	Transaction program name. Name of the program specified to be started as a result of the received program start request, even if a routing list caused a different program to be started.	ICF

Appendix B. Double-Byte Character Set Support

This appendix contains information that you need if you use double-byte characters. This includes the following topics:

- Double-byte character set (DBCS) fundamentals
- Processing double-byte characters
- Device file support
- Display support
- Copying files that contain double-byte characters
- Writing application programs that process double-byte characters
- DBCS font tables
- DBCS sort tables
- DBCS conversion dictionaries
- Using DBCS conversion

DBCS printer and spooling support information can be found in the *Guide to Programming for Printing*.

Double-Byte Character Set Fundamentals

Some languages, such as Chinese, Japanese, and Korean, have a writing scheme that uses many different characters that cannot be represented with single-byte codes. To create coded character sets for such languages, the system uses two bytes to represent each character. Characters that are encoded in two-byte code are called double-byte characters.

Figure B-1 shows alphanumeric characters coded in a single-byte code scheme and double-byte characters coded in a double-byte code scheme.

You can use double-byte characters as well as single-byte characters in one application. For instance, you may want to store double-byte data and single-byte data in your database, create your display screens with double-byte text and fields, or print reports with double-byte characters.

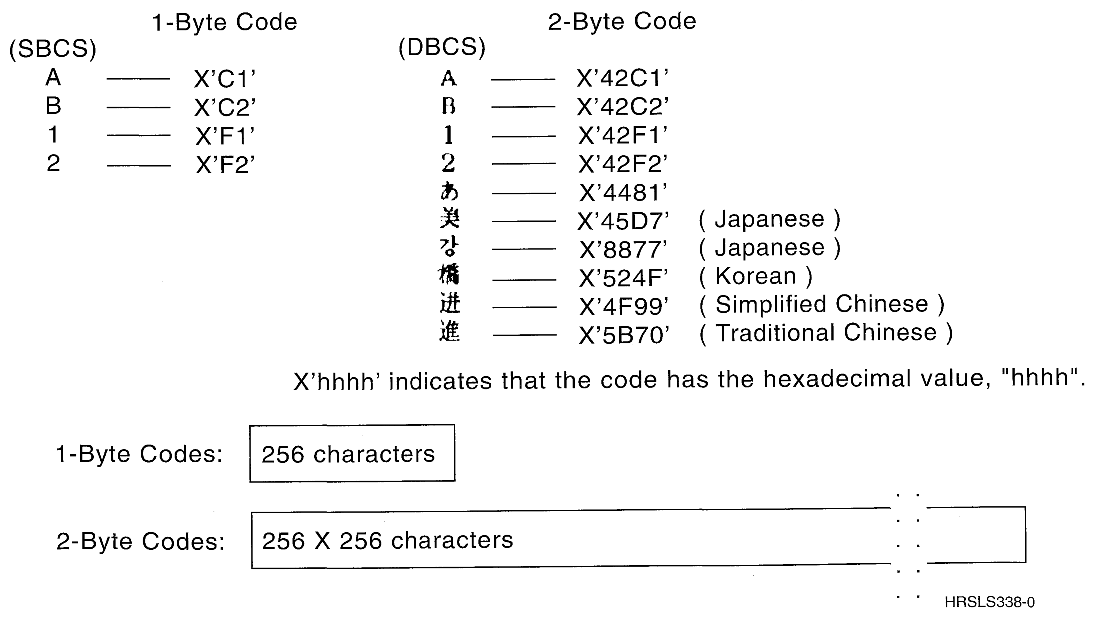

1-Byte Code
(SBCS)
A —— X'C1'
B —— X'C2'
1 —— X'F1'
2 —— X'F2'
2-Byte Code
(DBCS)
Ａ —— X'42C1'
Ｂ —— X'42C2'
１ —— X'42F1'
２ —— X'42F2'
あ —— X'4481'
美 —— X'45D7' (Japanese)
강 —— X'8877' (Japanese)
橋 —— X'524F' (Korean)
进 —— X'4F99' (Simplified Chinese)
進 —— X'5B70' (Traditional Chinese)
X'hhhh' indicates that the code has the hexadecimal value, "hhhh".
1-Byte Codes: 256 characters
2-Byte Codes: 256 X 256 characters
HRSLS338-0

Figure B-1. Single-byte and Double-byte Code Schemes

DBCS Code Scheme

IBM supports two DBCS code schemes: one for the host systems, the other for personal computers. The IBM-host code scheme has the following code-range characteristics:

First byte
: hex 41 to hex FE

Second byte
: hex 41 to hex FE

Double-byte blank
: hex 4040

In the following figure, using the first byte as the vertical axis and the second byte as the horizontal axis, 256 x 256 intersections or **code points** are expressed. The lower-right code area is designated as the valid double-byte code area and x is assigned to the double-byte blank.

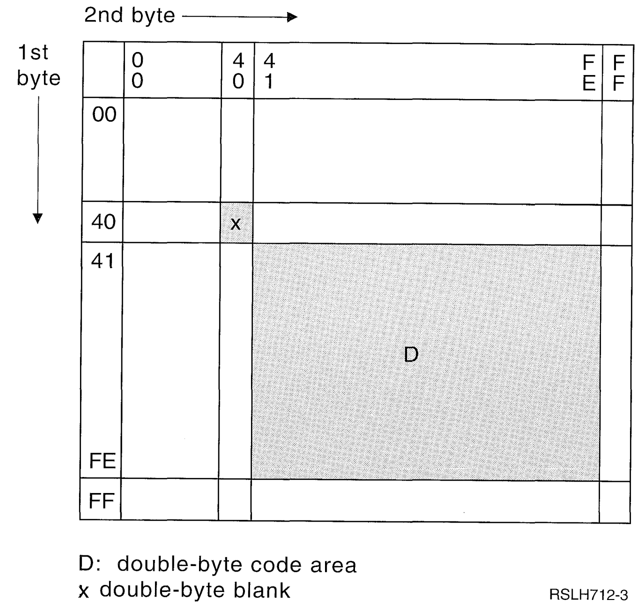


Figure B-2. IBM-Host Code Scheme

By assigning the values hex 41 to hex FE in the first and second bytes as the DBCS codes, the codes can be grouped in wards with 192 code points in each ward. For example, the code group with the first byte starting with hex 42 is called *ward 42*. Ward 42 has the same alphanumeric characters as those in a corresponding single-byte EBCDIC code page, but with double-byte codes. For example, the character *A* is represented in single-byte EBCDIC code as hex C1 and in IBM-host code as hex 42C1.

The AS/400 system supports the following double-byte character sets:

- IBM Japanese Character Set
- IBM Korean Character Set
- IBM Simplified Chinese Character Set
- IBM Traditional Chinese Character Set

The following tables show the code ranges for each character set and the number of characters supported in each character set.

Table B-1. IBM Japanese Character Set

Wards	Content	Number of Characters
40	Space in 4040	1
41 to 44	Non-Kanji characters • Greek, Russian, Roman numeric (Ward 41) • Alphanumeric and related symbols (Ward 42) • Katakana, Hiragana, and special symbols (Ward 43-44)	549
45 to 55	Basic Kanji characters	3226
56 to 68	Extended Kanji characters	3487
69 to 7F	User-defined characters	Up to 4370
80 to FE	Reserved	
Total number of IBM-defined characters: 7263		

Table B-2. IBM Korean Character Set

Wards	Content	Number of Characters
40	Space in 4040	1
41 to 46	Non-Hangeul/Hanja characters (Latin alphabet, Greek, Roman, Japanese Kana, numeric, special symbols)	939
47 to 4F	Reserved	
50 to 6C	Hanja characters	5265
6D to 83	Reserved	
84 to D3	Hangeul characters (Jamo included)	2672
D4 to DD	User-defined characters	Up to 1880
DE to FE	Reserved	
Total number of IBM-defined characters: 8877		

Table B-3. IBM Simplified Chinese Character Set

Wards	Content	Number of Characters
40	Space in 4040	1
41 to 47	Non-Chinese characters (Latin alphabet, Greek, Russian, Japanese Kana, numeric, special symbols)	712
48 to 6F	Chinese characters: Level 1 and Level 2	3755 and 3008
70 to 75	Reserved	
76 to 7F	User-defined characters	Up to 1880
80 to FE	Reserved	
Total number of IBM-defined characters: 7476		

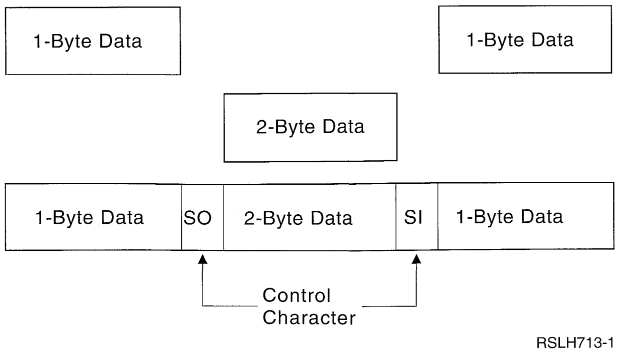
Table B-4. IBM Traditional Chinese Character Set

Wards	Content	Number of Characters
40	Space in 4040	1
41 to 49	Non-Chinese characters (Latin alphabet, Greek, Roman, Japanese Kana, numeric, special symbols)	1003
4A to 4B	Reserved	
4C to 68	Primary Chinese characters	5402
69 to 91	Secondary Chinese characters	7654
92 to C1	Reserved	
C2 to E2	User-defined characters	Up to 6204
E3 to FE	Reserved	
Total number of IBM-defined characters: 14060		

This code scheme applies to the AS/400 system, System/36, System/38, as well as the System/370* system. A different DBCS code scheme, called the IBM Personal Computer DBCS code scheme, is used on the Personal System/55. For details of the IBM Personal Computer DBCS code scheme, refer to IBM PS/55 publications.

Shift-Control Characters

When the IBM-host code scheme is used, the system uses shift-control characters to identify the beginning and end of a string of double-byte characters. The shift-out (SO) character, hex 0E, indicates the beginning of a double-byte character string. The shift-in (SI) character, hex 0F, indicates the end of a double-byte character string.



Each shift-control character occupies the same amount of space as one alphanumeric character. By contrast, double-byte characters occupy the same amount of space as two alphanumeric characters.

When double-byte characters are stored in a graphic field or a variable of graphic data type, there is no need to use shift control characters to surround the double-byte characters.

Invalid Double-Byte Code and Undefined Double-Byte Code

Invalid double-byte code has a double-byte code value that is not in the valid double-byte code range. Figure B-2 on page B-2 shows valid double-byte code ranges. This is in contrast to undefined double-byte code where the double-byte code is valid, but no graphic symbol has been defined for the code.

Using Double-Byte Data

This section tells you where you can use double-byte data and discusses the limitations to its use.

Where You Can Use: You can use double-byte data in the following ways:

- As data in files:
  - Data in database files.
  - Data entered in input-capable and data displayed in output-capable fields of display files.
  - Data printed in output-capable fields in printer files.
  - Data used as literals in display files and printer files.

- As the text of messages.
- As the text of object descriptions.
- As literals and constants, and as data to be processed by high-level language programs.

Double-byte data can be displayed only at DBCS display stations and printed only on DBCS printers. Double-byte data can be written onto diskette, tape, disk, and optical storage.

Where You Cannot Use: You cannot use double-byte data in the following ways:

- As AS/400 object names.
- As command names or variable names in control language (CL) and other high-level languages.
- As displayed or printed output on alphanumeric work stations.

Double-Byte Character Size

When displayed or printed, double-byte characters usually are twice as wide as single-byte characters.

Consider the width of double-byte characters when you calculate the length of a double-byte data field because field lengths are usually identified as the number of single-byte character positions used. For more information on calculating the length of fields containing double-byte data, refer to the *DDS Reference*.

Processing Double-Byte Characters

Due to the large number of double-byte characters, the system needs more information to identify each double-byte character than is needed to identify each alphanumeric character.

There are two types of double-byte characters: basic and extended. These characters are usually processed by the device on which the characters are displayed or printed.

Basic Characters

Basic characters are frequently used double-byte characters that reside in the hardware of a DBCS-capable device. The number of double-byte characters stored in the device varies with the language supported and the storage size of the device. A DBCS-capable device can display or print basic characters without using the extended character processing function of the operating system.

Extended Characters

When processing extended characters, the device requires the assistance of the system. The system must tell the device what the character looks like before the device can display or print the character. **Extended characters** are stored in a DBCS font table, not in the DBCS-capable device. When displaying or printing extended characters, the device receives them from the DBCS font table under control of the operating system.

Extended character processing is a function of the operating system that is required to make characters stored in a DBCS font table available to a DBCS-capable device.

To request extended character processing, specify the double-byte extended character parameter, IGCEXNCHR(*YES), on the file creation command when you create a display (CRTDSPF command) or printer file (CRTPRTF command) that processes double-byte data. Because IGCEXNCHR(*YES) is the default value, the system automatically processes extended characters unless you instruct it otherwise. You can change this file attribute by using a change file (CHGDSPF or CHGPRTF) or override file (OVRDSPF or OVRPRTF) command. For example, to override the display file DBCSDSPF so that extended characters are processed, enter:

```
OVRDSPF DSPF(DBCSDSPF) IGCEXNCHR(*YES)
```

Notes:

1. The system ignores the IGCEXNCHR parameter when processing alphanumeric files.
2. When you use the Japanese 5583 Printer to print extended characters, you must use the Kanji print function of the Advanced DBCS

Printer Support licensed program. Refer to the *Kanji Print Function User's Guide and Reference* for how to use this utility.

What Happens When Extended Characters Are Not Processed

When extended characters are not processed, the following happens:

- Basic double-byte characters are displayed and printed.
- On displays, the system displays the undefined character where it would otherwise display extended characters.
- On printed output, the system prints the undefined character where it would otherwise print extended characters.
- The extended characters, though not displayed or printed, are stored correctly in the system.

Device File Support

The following sections describe DBCS-capable device files and special considerations for working with DBCS-capable device files. Data description specifications (DDS), a language used to describe files, can be used with DBCS-capable device files. For information about using DDS, refer to the *DDS Reference* manual.

What a DBCS File Is

A **DBCS file** is a file that contains double-byte data or is used to process double-byte data. Other files are called **alphanumeric files**.

The following types of device files can be DBCS files:

- Display
- Printer
- Tape
- Diskette
- ICF

When to Indicate a DBCS File

You should indicate that a file is DBCS in one or more of the following situations:

- The file receives input, or displays or prints output, which has double-byte characters.
- The file contains double-byte literals.
- The file has double-byte literals in the DDS that are used in the file at processing time (such as constant fields and error messages).
- The DDS of the file includes DBCS keywords. See the *DDS Reference* for information on these keywords.
- The file stores double-byte data (database files).

How to Indicate a DBCS File

You must indicate that a device file is a DBCS file in order for the system to process double-byte data properly. You can do this in one of the following ways:

- Through DDS
  - DDS provides fields of the following data types.
    - **DBCS-only fields:** display and accept only double-byte characters. Double-byte characters in a DBCS-only field are enclosed in shift-out and shift-in characters that have to be paired.
    - **DBCS-open fields:** display and accept both single-byte and double-byte characters. Double-byte characters are enclosed in shift-out and shift-in characters that have to be paired.
    - **DBCS-either fields:** display and accept *either* single-byte or double-byte characters, but not *both*. Double-byte characters are enclosed in shift-out and shift-in character pairs.
    - **DBCS-graphic fields:** display and accept only double-byte characters. Characters in a DBCS-graphic field do not have shift-out and shift-in characters. The AS/400 DBCS-graphic field is equivalent to a System/370 DBCS field.

- In ICF files, by defining fields with DBCS-open data type (type O).
- In printer files, by defining fields with DBCS-open data type (type O) and DBCS-graphic data type (type G).
- In display files, by defining fields with DBCS-only data type (type J), DBCS-either data type (type E), DBCS-open data type (type O), or DBCS-graphic data type (type G).
- By using a double-byte literal that is used with the file at processing time, such as literals specified with the Default (DFT) and Error Message (ERRMSG) DDS keywords.

  Note: You may also use double-byte literals as text and comments in a file, such as with the DDS keyword TEXT. However, the system does not consider a file, whose only DBCS usage is that it has double-byte comments, to be a DBCS file.
- By specifying the Alternative Data Type (IGCALTTYP) DDS keyword in display and printer files. This keyword lets you use display and printer files with both alphanumeric and double-byte applications. When you put the IGCALTTYP keyword into effect, you can use double-byte data with the file.

  Put the IGCALTTYP keyword into effect by creating, changing, or overriding display and printer files with the IGCDTA(*YES) value. You can put the IGCALTTYP keyword into effect for display and printer files by specifying IGCDTA(*YES) on the following device file commands:

  - Create Display File (CRTDSPF)
  - Create Printer File (CRTPRTF)
  - Change Display File (CHGDSPF)
  - Change Printer File (CHGPRTF)
  - Override with Display File (OVRDSPF)
  - Override with Printer File (OVRPRTF)

  When you specify IGCDTA(*NO), the IGCALTTYP keyword is not in effect and you can use only alphanumeric data with the file. Changing or overriding the file to put the IGCALTTYP keyword into effect does not change the DDS of the file.

  Except when using the IGCALTTYP function, you do not need to specify IGCDTA(*YES) on the file creation command if you have already specified DBCS functions in the DDS. Instead, specify IGCDTA(*YES) when the file has DBCS functions that are not indicated in the DDS. For example, specify IGCDTA(*YES) on the file creation command if the file is intended to contain double-byte data.

- By specifying IGCDTA(*YES) on the following device file creation commands:
  - Create Diskette File (CRTDKTF)
  - Create Display File (CRTDSPF)
  - Create Printer File (CRTPRTF)
  - Create Tape File (CRTTAPF)
- By specifying IGCDTA(*YES) on the following database file creation commands:
  - Create Physical File (CRTPF)
  - Create Source Physical File (CRTSRCPF)

Improperly Indicated DBCS Files

If you do not properly indicate that a file is a DBCS file, one of the following happens:

- For printer files, printer data management assumes the output data to the printer does not contain double-byte data. The end result depends on the type of printer the data is printed on and the status of the replace unprintable character parameter for the printer file you are using.

  If the replace-unprintable-character option is selected, printer data management interprets shift-control characters as unprintable characters and replaces them with blanks. The double-byte data itself is interpreted as alphanumeric data, and the printer attempts to print it as such. The printed double-byte data does not make sense.

  If the replace-unprintable-character option is not selected and the printer is an alphanumeric printer, the double-byte data, including the control characters, is sent as is to the printer. On most alphanumeric printers, the shift-control characters are not supported, and an error will occur at the printer.

  If the replace-unprintable-character option is not selected and the printer is a DBCS printer, the double-byte data is printed with the exception of extended characters. Because the file was not indicated as a DBCS file, the system will not perform extended character processing. The extended characters are printed with the symbol for undefined double-byte characters.

- For display files, display data management assumes that the output data to the display does not contain double-byte data. The end result depends on whether the display is an alphanumeric or DBCS display.

  If the display is an alphanumeric display, the double-byte data is interpreted as alphanumeric data. The shift-control characters appear as blanks. The displayed double-byte data does not make sense.

  If the display is a DBCS display, the double-byte data is displayed with the exception of extended characters. The system does not perform extended character processing on the data. Therefore, extended characters are displayed with the symbol for undefined double-byte characters.

- The system does not recognize literals with DBCS text as double-byte literals if the source file is not specified as a DBCS file.

Making Printer Files Capable of DBCS: In many cases, printer files are used by the system to produce data that will eventually be printed or displayed. In these cases, the data is first placed into a spooled file using one of the IBM-supplied printer files. The data is then taken from the spooled file and is displayed or printed based on the request of the user.

When the data involved contains double-byte characters, the printer file that is used to place the data into the spooled file must be capable of processing double-byte data. A printer file is capable of processing double-byte data when *YES is specified on the IGCDTA parameter for the file. In most cases, the system recognizes the occurrence of double-byte data and takes appropriate measures to ensure the printer file that is used is capable of processing double-byte data.

In some cases, however, the system cannot recognize the occurrence of double-byte data and may attempt to use a printer file that is not capable of processing double-byte data. If this occurs, the output at the display or printer may not be readable. This can happen when object descriptions containing double-byte characters are to be displayed or printed on an alphanumeric device.

To ensure that you receive correct results when you display or print double-byte characters, some recommendations should be followed. Action is required on your part if you have a single-byte national language installed as a secondary language. Printer files that are received as part of the DBCS version of a product are always capable of processing DBCS data.

The following recommended actions should be performed after the product or feature has been installed:

1. If all printers and display devices attached to your system are DBCS-capable, you can enable all printer files for double-byte data. For IBM-supplied printer files that are received as part of a single-byte secondary language feature, you can enable all printer files by issuing the following command:

   ```
   CHGPRTF FILE(*ALL/*ALL) IGCDTA(*YES)
   ```

   After this command has been completed, all printer files in all libraries will be enabled for double-byte data. The change will be a permanent change.

2. If all printer and display devices attached to your system are not DBCS-capable, it is recommended that you do not enable all IBM-supplied printer files.

   Instead, use the library search capabilities of the system to control which printer files will be used for any particular job. When the potential exists that double-byte data will be encountered, the library list for the job should be such that the printer files that are DBCS-enabled will be found first in the library list. Conversely, if only single-byte data is expected to be encountered, the library list should be set up so the printer files that are not enabled for DBCS will be found first. In this way, the printer file capabilities will match the type of data that will be processed. The decision as to what type of printer file to use is made on the basis of what type of data will be processed. The device that will be used to actually display or print the data may also influence this decision.

In some cases it may be desirable to make the printer file only temporarily DBCS-capable instead of making a permanent change. For a specific job, you can make this temporary change by using the OVRPRTF command.

To temporarily enable a specific printer file, you can use the following command:

```
OVRPRTF FILE(filename) IGCDTA(*YES)
```

Where filename is the name of the printer file you want to enable.

Display Support

The following sections describe information on displaying double-byte characters.

Inserting Shift-Control Characters

The system inserts shift-control characters into DBCS-only fields automatically.

To insert shift-control characters into open fields or either fields, do the following:

1. Position the cursor in the field in which you want to insert double-byte data.
2. Press the Insert Shift Control Character key (according to your DBCS display station user's guide).

The system inserts a pair of shift-control characters at the same time, as follows (where 0_E represents the shift-out character and 0_F represents the shift-in character):

0_E0_F

The system leaves the cursor under the shift-in character and puts the keyboard in insert mode. Insert double-byte characters between the shift-control characters. To insert double-byte characters, start keying in double-byte characters at the cursor position. For example, enter the double-byte character string D1D2D3, as follows (where 0_E represents the shift-out character, 0_F represents the shift-in character, and D1, D2, and D3 represent three double-byte characters):

0_ED1D2D3$0_F$

To find out if a field already has the shift-control characters, press the Display Shift Control Character key.

DBCS-graphic fields store double-byte characters without requiring the use of shift control characters. Shift control characters should not be inserted in graphic fields.

Number of Displayed Extended Characters

The system can display up to 512 different extended characters on a Japanese display at one time. Additional extended characters are displayed as undefined characters. However, the additional extended characters are stored correctly in the system.

Number of Input Fields on a Display

The use of DBCS input fields affects the total number of input fields allowed on a display. For a local 5250 display station, you can specify as many as 256 input fields. However, each three instances of a DBCS field reduces the maximum number of fields by one. For example, if there are 9 DBCS fields on a display, then the maximum is 256 − (9/3) = 253 input fields.

Effects of Displaying Double-Byte Data at Alphanumeric Work Stations

Alphanumeric display stations cannot display double-byte data correctly. If you try to display double-byte data at an alphanumeric display station, the following happens:

- The system sends an inquiry message to that display station, asking whether you want to continue using the program with double-byte data or to cancel it.
- If you continue using the program, the system ignores the shift-control characters and interprets the double-byte characters as though they were single-byte characters. Displayed double-byte data does not make sense.

Copying Files

You can copy both spooled and nonspooled DBCS files.

Copying Spooled Files

Copy spooled files that have double-byte data by using the Copy Spooled File (CPYSPLF) command. However, the database file to which the file is being copied must have been created with the IGCDTA(*YES) value specified.

When copying spooled files to a database file that contains double-byte data, an extra column is reserved for the shift-out character. This shift-out character is placed between the control information for the record and the user data. The following table shows the shift-out character column number, based on the value specified for the Control Character (CTLCHAR) keyword:

CTLCHAR Value	Column for Shift-Out Character
*NONE	1
*FCFC	2
*PRTCTL	5
*S36FMT	10

Copying Nonspooled Files

You can use the Copy File (CPYF) command to copy double-byte data from one file to another.

When copying data from a double-byte database file to an alphanumeric database file, specify one of the following on the CPYF command:

- If both files are source files or if both files are database files, you can specify either the FMTOPT(*MAP) parameter or the FMTOPT(*NOCHK) parameter.
- If one file is a source file and the other file is a database file, specify the FMT(*CVTSRC) parameter.

When you copy DBCS files to alphanumeric files, the system sends you an informational message describing the difference in file types.

Either the FMTOPT(*MAP) or FMTOPT(*NOCHK) option of the copy file function must be specified for copies from a physical or logical file to a physical file when there are fields with the same name in the from-file and to-file, but the data type for fields is as shown in the following table.

From-File Field Data Type	To-File Field Data Type
A (character)	J (DBCS-only)
O (DBCS-open)	J (DBCS-only)
O (DBCS-open)	E (DBCS-either)
E (DBCS-either)	J (DBCS-only)
J (DBCS-only)	G (DBCS-graphic)
O (DBCS-open)	G (DBCS-graphic)
E (DBCS-either)	G (DBCS-graphic)
G (DBCS-graphic)	J (DBCS-only)
G (DBCS-graphic)	O (DBCS-open)
G (DBCS-graphic)	E (DBCS-either)

When you use FMTOPT(*MAP) on the CPYF command to copy data to a DBCS-only field or DBCS-graphic field, the corresponding field in the from-file must *not* be:

- Less than a 2-byte character field
- An odd-byte-length character field
- An odd-byte-length DBCS-open field

If you attempt to copy with one of these specified in the from-field, an error message is sent.

When you copy double-byte data from one database file to another with the FMTOPT(*MAP) parameter specified, double-byte data will be copied correctly. The system will perform correct padding and truncation of double-byte data to ensure data integrity.

When using the CPYF command with FMTOPT(*MAP) to copy a DBCS-open field to a graphic field, a conversion error occurs if the DBCS-open field contains any SBCS data (including blanks). For more information see "DBCS-Graphic Fields" on page 4-33.

Application Program Considerations

The following sections describe considerations for writing applications that process double-byte data.

Designing Application Programs That Process Double-Byte Data

Design your application programs for processing double-byte data in the same way you design application programs for processing alphanumeric data, with the following additional considerations:

- Identify double-byte data used in the database files.
- Design display and printer formats that can be used with double-byte data.
- If needed, provide DBCS conversion as a means of entering double-byte data for interactive applications. Use the DDS keyword for DBCS conversion (IGCCNV) to specify DBCS conversion in display files. Because DBCS work stations provide a variety of double-byte data entry methods, you are not required to use the AS/400 DBCS conversion function to enter double-byte data.
- Create double-byte messages to be used by the program.
- Specify extended character processing so that the system prints and displays all double-byte data. See "Extended Characters" on page B-4 for instructions.
- Determine whether additional double-byte characters need to be defined. User-defined characters can be defined and maintained using the **character generator utility (CGU)**. Information on CGU can be found in the *CGU User's Guide*.

When you write application programs to process double-byte data, make sure that the double-byte data is always processed in a double-byte unit and do not split a double-byte character.

Changing Alphanumeric Application Programs to DBCS Application Programs

If an alphanumeric application program uses externally described files, you can change that application program to a DBCS application program by changing the externally described files. To convert an application program, do the following:

1. Create a duplicate copy of the source statements for the alphanumeric file that you want to change.
2. Change alphanumeric constants and literals to double-byte constants and literals.
3. Change fields in the file to the open (O) data type or specify the Alternative Data Type (IGCALTTYP) DDS keyword so that you can enter both double-byte and alphanumeric data in these fields. You may want to change the length of the fields as the double-byte data takes more space.
4. Store the converted file in a separate library. Give the file the same name as its alphanumeric version.
5. When you want to use the changed file in a job, change the library list, using the Change Library List (CHGLIBL) command, for the job in which the file will be used. The library in which the DBCS display file is stored is then checked before the library in which the alphanumeric version of the file is stored.

DBCS Font Tables

DBCS font tables contain the images of the double-byte extended characters used on the system. The system uses these images to display and print extended characters.

The following DBCS font tables are objects that you can save or restore. These font tables are distributed with the DBCS national language versions of the OS/400 licensed program:

QIGC2424
: A Japanese DBCS font table used to display and print extended characters in a 24-by-24 dot matrix image. The system uses the table with Japanese display stations, printers attached to display stations, 5227 Model 1 Printer, and the 5327 Model 1 Printer.

QIGC2424C
: A Traditional Chinese DBCS font table used to print extended characters in a 24-by-24 dot matrix image. The system uses the table with the 5227 Model 3 Printer and the 5327 Model 3 Printer.

QIGC2424K
: A Korean DBCS font table used to print extended characters in a 24-by-24 dot matrix image. The system uses the table with the 5227 Model 2 Printer and the 5327 Model 2 Printer.

QIGC2424S
: A Simplified Chinese DBCS font table used to print extended characters in a 24-by-24 dot matrix image. The system uses the table with the 5227 Model 5 Printer.

QIGC3232
: A Japanese DBCS font table used to print characters in a 32-by-32 dot matrix image. The system uses the table with the 5583 Printer and the 5337 Model 1 Printer.

QIGC3232S
: A Simplified Chinese DBCS font table used to print characters in a 32-by-32 dot matrix image. The system uses the table with the 5337 Model R05 Printer.

All DBCS font tables have an object type of *ICGTBL. You can find instructions for adding user-defined characters to DBCS font tables in the *CGU User's Guide*.

Commands for DBCS Font Tables

The following commands allow you to manage and use DBCS font tables:

- Check DBCS Font Table (CHKIGCTBL)
- Copy DBCS Font Table (CPYIGCTBL)
- Delete DBCS Font Table (DLTIGCTBL)
- Start Character Generator Utility (STRCGU)
- Start Font Management Aid (STRFMA)

Finding Out if a DBCS Font Table Exists

Use the Check DBCS Font Table (CHKIGCTBL) command to find out if a DBCS font table exists in your system.

For example, to find out if the table QIGC2424 exists, enter:

```
CHKIGCTBL IGCTBL(QIGC2424)
```

If the table does not exist, the system responds with a message. If the table does exist, the system simply returns without a message.

Check for the existence of a table when adding a new type of DBCS work station to make sure that the table used by the device exists in the system.

Copying a DBCS Font Table onto Tape or Diskette

Use the Copy DBCS Font Table (CPYIGCTBL) command to copy a DBCS font table onto tape or diskette.

The DBCS font tables are saved when you use the Save System (SAVSYS) command so you do not have to use the CPYIGCTBL command when performing normal system backup.

When to Copy a Table onto Tape or Diskette: Copy a DBCS font table onto tape or diskette in the following instances:

- Before deleting that table.
- After new user-defined characters are added to the tables.
- When planning to use the tables on another system.

How to Copy a Table onto Tape or Diskette: To copy a DBCS font table onto a tape or diskettes, do the following:

1. Make sure that you have a tape or diskettes initialized to the *DATA format. If necessary, initialize the tape or diskettes by specifying the FMT(*DATA) parameter on the Initialize Diskette (INZDKT) command. See the *Guide to Programming for Tape and Diskette* for complete instructions on initializing tapes and diskettes.
2. Load the initialized tape or diskette onto the system.
3. Enter the CPYIGCTBL command as follows:
   a. Choose the value OPTION(*OUT).
   b. Use the DEV parameter to select the device to which you want to copy the table.
   c. Use the SELECT and RANGE parameters to specify which portion of the table you want copied from the system. See the description of the CPYIGCTBL command in the *CL Reference* manual for

instructions on choosing SELECT and RANGE parameter values.

The following are two examples of the CPYIGCTBL command used to copy a DBCS font table to removable media.

- To copy the DBCS font table QIGC2424 onto diskettes, enter:

```
CPYIGCTBL IGCTBL(QIGC2424) OPTION(*OUT)  +
  DEV(QDKT)
```

- To copy just the user-defined characters from DBCS font table QIGC2424 onto tape, enter:

```
CPYIGCTBL IGCTBL(QIGC2424) OPTION(*OUT)  +
  DEV(QTAP01) SELECT(*USER)
```

4. Press the Enter key. The system copies the DBCS font table onto the specified media.
5. Remove the tape or diskette after the system finishes copying the table.

Copying a DBCS Font Table from Tape or Diskette

Use the Copy DBCS Font Table (CPYIGCTBL) command to copy a DBCS font table from a tape or a diskette onto the system. The system automatically creates the DBCS font table again when copying its contents if the following are true:

- The specified table does not already exist in the system.
- The media from which you are copying the table contains all of the IBM-defined double-byte characters.
- SELECT(*ALL) or SELECT(*SYS) is specified on the CPYIGCTBL command.

How to Copy a Table from a Tape or Diskette:

To copy a DBCS font table from tape or diskette onto the system:

1. Load the removable media from which the table will be copied onto the system.
2. Enter the CPYIGCTBL command as follows:
   a. Choose the OPTION(*IN) value.
   b. Use the DEV parameter to select the device from which to copy the DBCS font table.
   c. Use the SELECT and RANGE parameters to specify which portion of the table will be copied from the tape or diskette. See the *CL Reference* for a description of the CPYIGCTBL command and for instructions on choosing SELECT and RANGE parameter values.

   The following are two examples of commands used to copy a DBCS font table to the system.

   - To copy the DBCS font table QIGC2424 from diskette, enter:

```
CPYIGCTBL IGCTBL(QIGC2424) OPTION(*IN) +
  DEV(QDKT)
```

   - To copy just the user-defined characters from DBCS font table QIGC2424 from tape and to replace the user-defined characters in the table with the ones from the tape, enter:

```
CPYIGCTBL IGCTBL(QIGC2424) OPTION(*IN) +
  DEV(QTAP01) SELECT(*USER) RPLIMG(*YES)
```

3. Press the Enter key. The system copies the DBCS font table from the tape or diskette onto the system.
4. Remove the tape or diskette after the system finishes copying the table.

Deleting a DBCS Font Table

Use the Delete DBCS Font Table (DLTIGCTBL) command to delete a DBCS font table from the system.

When to Delete a DBCS Font Table:

Delete an unused DBCS font table to free storage space. For example, if you do not plan to use Japanese printer 5583 or 5337 with your system, font table QIGC3232 is not needed and can be deleted.

How to Delete a DBCS Font Table:

When deleting a table, do the following:

1. If desired, copy the table onto tape or diskettes. See “Copying a DBCS Font Table onto Tape or Diskette” on page B-11 for instructions. If you do not copy the table to removable media before deleting it, you will not have a copy of the table for future use.
2. Vary off all devices using that table.
3. Enter the DLTIGCTBL command.

   For example, to delete the DBCS font table QIGC3232, enter:

```
DLTIGCTBL IGCTBL(QIGC3232)
```

4. Press the Enter key. The system sends inquiry message CPA8424 to the system operator message queue for you to confirm your intention to delete a DBCS table.
5. Respond to the inquiry message. The system sends you a message when it has deleted the table.

Note: Do not delete a DBCS font table if any device using that table is currently varied on. Also, make sure that the affected controller is not varied on. If you try to delete the table while the device and controller are varied on, the system reports any devices attached to the same controller(s) as those devices, and the controller(s) as damaged the next time you try to print or display extended characters on an affected device. If such damage is reported, do the following:

1. Vary off the affected devices, using the Vary Configuration (VRYCFG) command.
2. Vary off the affected controller.
3. Vary on the affected controller.
4. Vary on the affected devices.
5. Continue normal work.

Starting the Character Generator Utility

Use the STRCGU command to start the character generator utility. You may call the CGU main menu or specify a specific CGU function, depending on the parameter used. Refer to the *CGU User's Guide* for more information.

Copying User-Defined Double-Byte Characters

Use the STRFMA command to copy user-defined double-byte characters between an AS/400 DBCS font table and a user font file at a Personal System/55, a 5295 Display Station, or an InfoWindow* 3477 Display Station. Refer to the *Font Management Aid User's Guide* on how to use this command.

DBCS Font Files

In addition to the system-supplied DBCS font tables, the system also provides DBCS font files. These DBCS font files are physical files which contain frequently used double-byte characters. When using the character generator utility, you can use the characters in these files as the base for a new user-defined character. These files are supplied with read-only authority as they are not to be changed. If you do not use character generator utility or the Advanced DBCS Printer Support licensed program, you may delete these files to save space. They all exist in the QSYS library.

The following DBCS font files are distributed with the DBCS national language versions of the OS/400 licensed program. They are used as a reference for the CGU and the AS/400 Advanced DBCS Printer Support licensed program.

QCGF2424
: A Japanese DBCS font file used to store a copy of the Japanese DBCS basic character images.

QCGF2424K
: A Korean DBCS font file used to store a copy of the Korean DBCS basic character images.

QCGF2424C
: A Traditional Chinese DBCS font file used to store a copy of the Traditional Chinese DBCS basic character images.

QCGF2424S
: A Simplified Chinese DBCS font file used to store a copy of the Simplified Chinese DBCS basic character images.

DBCS Sort Tables

DBCS sort tables contain the sort information and collating sequences of all the double-byte characters used on the system. The system uses these tables to sort double-byte characters using the sort utility.

DBCS sort tables are objects that you can save, restore and delete. Using the character generator utility you can also add, delete and change entries in these tables corresponding to the image entries in the DBCS font tables. For Japanese use only, you can also copy the DBCS master sort table to and from a data file.

The following DBCS sort tables are distributed with the DBCS national language versions of OS/400 licensed program:

QCGMSTR
: A Japanese DBCS master sort table used to store the sort information for the Japanese double-byte character set.

QCGACTV
: A Japanese DBCS active sort table used to store the sort collating sequences for the Japanese double-byte character set.

QCGMSTRC
: A Traditional Chinese DBCS master sort table used to store the sort information for the Traditional Chinese double-byte character set.

QCGACTVC
: A Traditional Chinese DBCS active sort table used to store the sort collating sequences for the Traditional Chinese double-byte character set.

QCGACTVK
: A Korean DBCS active sort table used to map Hanja characters to Hangeul characters with equivalent pronunciation.

QCGMSTRS
: A Simplified Chinese DBCS master sort table used to store the sort information for the Simplified Chinese double-byte character set.

QCGACTVS
: A Simplified Chinese DBCS active sort table used to store the sort collating sequences for the Simplified Chinese double-byte character set.

You may sort Japanese, Korean, Simplified Chinese, and Traditional Chinese double-byte characters. Each of these languages have two DBCS sort tables, a DBCS master sort table and a DBCS active sort table, except for Korean which has only a DBCS active sort table. The DBCS master sort table contains sort information for all defined DBCS characters. The DBCS active sort table for Japanese, Simplified Chinese, and Traditional Chinese is created from the master sort table information and contains the collating sequences for the double-byte characters of that given language. These collating sequences have a purpose similar to the EBCDIC and ASCII collating sequences for the single-byte alphanumeric character set. For Korean characters, the Hangeul characters are assigned both their collating sequence as well as their DBCS codes according to their pronunciation. Hence, a separate collating sequence is not required, and each of the Hanja characters is mapped to a Hangeul character of the same pronunciation using the DBCS active sort table QCGACTVK. Refer to the *Sort User's Guide and Reference* for more information.

All DBCS sort tables have an object type of *IGCSRT.

Commands for DBCS Sort Tables

The following commands allow you to manage and use DBCS sort tables.

- Check Object (CHKOBJ)
- Save Object (SAVOBJ)
- Restore Object (RSTOBJ)
- Copy DBCS Sort Table (CPYIGCSRT) (for Japanese table only)
- Delete DBCS Sort Table (DLTIGCSRT)
- Start Character Generator Utility (STRCGU) (information on CGU can be found in the *CGU User's Guide*)

Using DBCS Sort Tables on the System

You can save the tables to tape or diskette, delete them from the system, and restore them to the system. The Japanese DBCS master sort table can also be copied to a data file and copied from a data file so that it can be shared with a System/36 or Application System/Entry* (AS/Entry) system. You can also add sort information for each user-defined character, and add that character to the DBCS collating sequence, as you create it using the character generator utility.

Finding Out if a DBCS Sort Table Exists

Use the Check Object (CHKOBJ) command to find out if a DBCS sort table exists in your system.

For example, to find out if the table QCGMSTR exists, enter:

```
CHKOBJ OBJ(QSYS/QCGMSTR) OBJTYPE(*IGCSRT)
```

If the table does not exist, the system responds with a message. If the table does exist, the system simply returns without a message.

Check for the existence of a DBCS active sort table when you want to sort double-byte characters for the first time. The DBCS active table for the DBCS language must exist to sort the characters.

Saving a DBCS Sort Table onto Tape or Diskette

Use the Save Object (SAVOBJ) command to save a DBCS sort table onto tape or diskette. Specify *IGCSRT for the object type.

The DBCS sort tables are saved when you use the SAVSYS command so you do not have to use the SAVOBJ command when performing normal system backup.

When to Save a DBCS Sort Table onto Tape or Diskette: Save a DBCS sort table onto tape or diskette in the following instances:

- Before deleting that table
- After information is added, updated, or changed in the tables using the character generator utility
- When planning to use the tables on another AS/400 system

Restoring a DBCS Sort Table from Tape or Diskette

Use the RSTOBJ command to restore a DBCS sort table from a tape or a diskette onto the system. The tables on the tape or diskette must previously have been saved using the SAVOBJ command. Specify *IGCSRT for the object type. The system automatically re-creates the DBCS sort table when the specified table does not already exist in the system.

These tables must be restored to the QSYS library for the system to know they exist. For that reason, RSTOBJ restores *IGCSRT objects only to the QSYS library and only if the objects do not already exist there.

Copying a Japanese DBCS Master Sort Table to a Data File

Through the character generator utility, use the CPYIGCSRT command to copy the Japanese DBCS master sort table (QCGMSTR) to a data file. This data file can then be moved to a System/36 system or AS/Entry system to replace the Japanese master sort table there.

When to Copy the Japanese DBCS Master Sort Table to a Data File: Copy the Japanese DBCS master sort table to a data file in the following instances:

- When planning to move the table to the System/36 or AS/Entry for use there. You should always transport the Japanese DBCS master sort table together with the Japanese DBCS font tables.
- Before deleting that table, as an alternative to the SAVOBJ command. You can then keep the file or save it on diskette or tape.

How to Copy the Japanese DBCS Master Sort Table to a Data File:

Note: In this section, the AS/Entry system also applies to every instance of System/36.

To copy the Japanese DBCS master sort table to a data file, do the following.

1. Decide what data file you want to copy it to. The file need not exist, it will be automatically created.
2. Enter the CPYIGCSRT command as follows:
   a. Choose the value OPTION(*OUT).
   b. Use the FILE parameter to specify the name of the data file to which you want to copy the master table. If you are transporting the master table to the System/36 for use there, you should specify a file name of #KAMAST, or you will have to rename the file when you get it to the System/36. Use the AS/400 CPYF command for copying the file onto diskette, and the System/36 TRANSFER command for copying the file from diskette to the System/36.
   c. Use the MBR parameter to specify the name of the data file member to which

you want to copy the master table. If you are transporting the master table to the System/36 for use there, you should specify *FILE for the MBR parameter.

3. Press the Enter key. The system creates the file and member if they do not exist, and overwrites the existing member if they do exist.
4. If you now transport this file to your System/36 to replace the #KAMAST file there, you should also use the SRTXBLD procedure to update the active table to reflect the new master table.

Copying a Japanese DBCS Master Sort Table from a Data File

Use the CPYIGCSRT command to copy the Japanese DBCS master sort table (QCGMSTR) from a data file.

When to Copy the Japanese DBCS Master Sort Table from a Data File:

You may use the System/36 Migration Aid to migrate the System/36 or AS/Entry master sort file (#KAMAST) to the AS/400 system. When you migrate the #KAMAST file using the System/36 Migration Aid, you do not have to use the CPYIGCSRT command.

Copy the Japanese DBCS master sort table from a data file in the following instances:

- When you do not use the System/36 Migration Aid, you may copy the #KAMAST file from the System/36 or AS/Entry to the AS/400 system. Then use the CPYIGCSRT command to copy sort information from the #KAMAST file to the AS/400 master sort table (QCGMSTR). Delete the #KAMAST file from the AS/400 system after you complete the copy operation.
- When you have copied a version of the master table to a data file and you now want to restore that version.

You should always migrate or copy the Japanese DBCS master sort table together with the Japanese DBCS font tables.

How to Copy the Japanese DBCS Master Sort Table from a Data File: To copy the Japanese DBCS master sort table from a data file, do the following:

1. Enter the CPYIGCSRT command as follows:
   a. Choose the value OPTION(*IN).
   b. Use the FILE parameter to specify the name of the data file that contains a migrated System/36 or AS/Entry master file or an AS/400 master table previously copied to the file using OPTION(*OUT) with the CPYIGCSRT command. To migrate your System/36 or AS/Entry master file without using the System/36 Migration Aid, use the TRANSFER command with the IFORMAT parameter on the System/36 or AS/Entry to save the #KAMAST master file on diskette. Use the AS/400 Copy File (CPYF) command to copy the master file #KAMAST from diskette. Use the CPYIGCSRT command as described here to copy data from the file to the AS/400 Japanese DBCS master sort table.
   c. Use the MBR parameter to specify the name of the data file member from which you want to copy the master table data.
2. Press the Enter key. Even though the information in the existing Japanese DBCS master sort table is overridden, that table must exist before you can use this command.
3. To update the Japanese DBCS active table to reflect the new copied information, use the SRTXBLD procedure in the System/36 or AS/Entry environment, or the STRCGU command specifying OPTION(5). This must be done before you can use the sort utility to sort Japanese double-byte characters.

Deleting a DBCS Sort Table

Use the DLTIGCSRT command to delete a DBCS sort table from the system.

When to Delete a DBCS Sort Table:

Delete an unused DBCS sort table to free disk space, but you should always first save a copy of the table using the SAVOBJ command. You should delete the DBCS master sort table for a DBCS language if any of the following are true:

1. You will not be creating any new characters for that language using the character generator utility.
2. You will not be using the sort utility to sort characters for that language.

You should delete the DBCS active sort table for a DBCS language if you will not be using the sort utility to sort characters for that language. The DBCS active sort table must be on the system to use the sort utility for this language.

How to Delete a DBCS Sort Table:

When deleting a table, do the following:

1. If desired, save the table onto tape or diskettes. See "Saving a DBCS Sort Table onto Tape or Diskette" on page B-15 for instructions. If you do not save the table onto removable media before deleting it, you will not have a copy of the table for future use.
2. Enter the DLTIGCSRT command.

   For example, to delete the DBCS sort table QCGACTV, enter:

   ```
   DLTIGCSRT IGCSRT(QCGACTV)
   ```
3. Press the Enter key. The system sends you a message when it has deleted the table.

DBCS Conversion Dictionaries

The DBCS conversion dictionary is a collection of alphanumeric entries and their related DBCS words. The system refers to the dictionary when performing DBCS conversion. See "How DBCS Conversion Works" on page B-24 for information on how the system uses the DBCS conversion dictionary during DBCS conversion.

All DBCS conversion dictionaries have an object type of *IGCDCT. A system-supplied and a user-created dictionary are used with DBCS conversion.

System-Supplied Dictionary (for Japanese Use Only)

QSYSIGCDCT, the system-supplied dictionary that is stored in the library, QSYS, is a collection of entries with a Japanese pronunciation expressed in alphanumeric characters and the DBCS words related to those entries. The system checks this dictionary second when performing DBCS conversion.

QSYSIGCDCT contains these entries:

- Personal names
  - Family names
  - First names
- Organization names
  - Private enterprises registered in the security market
  - Public corporations
  - Typical organizations in the central and local governments
  - Most universities and colleges
- Addresses
  - Public administration units within the prefectures
  - Towns and streets in 11 major cities
- Business terms, such as department names and position titles commonly used in enterprises
- Individual double-byte characters, including basic double-byte characters, as defined by IBM

You cannot add or delete entries from this dictionary. However, you may rearrange the related DBCS words so that the words used most frequently are displayed first during DBCS conversion. See "Editing a DBCS Conversion Dictionary" on page B-19 for instructions on rearranging terms.

User-Created Dictionary

A user-created dictionary contains any alphanumeric entries and related DBCS words that you choose to include. You might create a user dictionary to contain words unique to your business or words that you use regularly but that are not included in the system-supplied dictionary.

You can create one or more DBCS conversion dictionaries with any name and store them in any library. When performing DBCS conversion, however, the system only refers to the first user dictionary named QUSRIGCDCT in the user's library list, no matter how many dictionaries you have or what they are named. Make sure that the library list is properly specified so that the system checks the correct dictionary.

During DBCS conversion, the system checks QUSRIGCDCT before checking QSYSIGCDCT.

Commands for DBCS Conversion Dictionaries

You can use the following commands to perform object management functions with the DBCS conversion dictionary. Specify the OBJTYPE(*IGCDCT) parameter when entering these commands:

- CHGOBJOWN: Change the owner of a DBCS conversion dictionary
- CHKOBJ: Check a DBCS conversion dictionary
- CRTDUPOBJ: Create a duplicate object of the dictionary
- DMPOBJ: Dump a DBCS conversion dictionary
- DMPSYSOBJ: Dump the system-supplied dictionary
- DSPOBJAUT: Display a user's authority to the dictionary
- GRTOBJAUT: Grant authority to use the dictionary
- MOVOBJ: Move the dictionary to another library
- RNMOBJ: Rename the dictionary
- RSTOBJ: Restore the dictionary
- RVKOBJAUT: Revoke authority to use the dictionary
- SAVOBJ: Save the dictionary
- SAVCHGOBJ: Save a changed dictionary

The system saves or restores DBCS conversion dictionaries when you use these commands:

- RSTLIB: Restore a library in which the dictionary is stored
- SAVLIB: Save a library in which the dictionary is stored
- SAVSYS: Save QSYSIGCDCT, the system DBCS conversion dictionary, when saving the system

You can use the following commands to create, edit, display, and delete a dictionary:

- CRTIGCDCT: Create DBCS Conversion Dictionary
- EDTIGCDCT: Edit DBCS Conversion Dictionary
- DSPIGCDCT: Display DBCS Conversion Dictionary
- DLTIGCDCT: Delete DBCS Conversion Dictionary

Creating a DBCS Conversion Dictionary: To create a DBCS conversion dictionary, do the following:

1. Use the Create DBCS Conversion Dictionary (CRTIGCDCT) command.
2. Name the dictionary, QUSRIGCDCT, so it can be used during DBCS conversion. The system uses the dictionary if it is the first user-created dictionary found when searching a user's library list.

   You might call the dictionary by another name while it is being created to prevent application programs from using it for conversion. Later, change the dictionary name using the Rename Object (RNMOBJ) command.

   For example, to create a user DBCS conversion dictionary to be stored in the library DBCSLIB, enter:

   ```
   CRTIGCDCT IGCDCT(DBCSLIB/QUSRIGCDCT)
   ```
3. Use the EDTIGCDCT command to put entries and related words into the dictionary after creating it. See "Editing a DBCS Conversion Dictionary" on page B-19 for instructions on putting entries in the dictionary.

Editing a DBCS Conversion Dictionary:

Use the Edit DBCS Conversion Dictionary (EDTIGCDCT) command to edit the DBCS conversion dictionary. Use editing to add user-defined characters to the dictionary, so that users can enter characters using DBCS conversion, and rearrange terms in a DBCS conversion dictionary to suit individual needs.

Requirements for a DBCS Conversion Dictionary: The display station needed for use while editing the DBCS conversion dictionary depends on the value that you entered for the ENTRY parameter on the EDTIGCDCT command:

- If you specified a specific string with the ENTRY parameter or if you want to display double-byte characters, you must use a DBCS display station.
- If you did not specify a specific string with the ENTRY parameter, or if you do not want to display double-byte characters, use either a DBCS display station, or a 24-row by 80-column alphanumeric display station.

DBCS Conversion Dictionary Operations: You may perform the following editing operations on a user-created DBCS conversion dictionary:

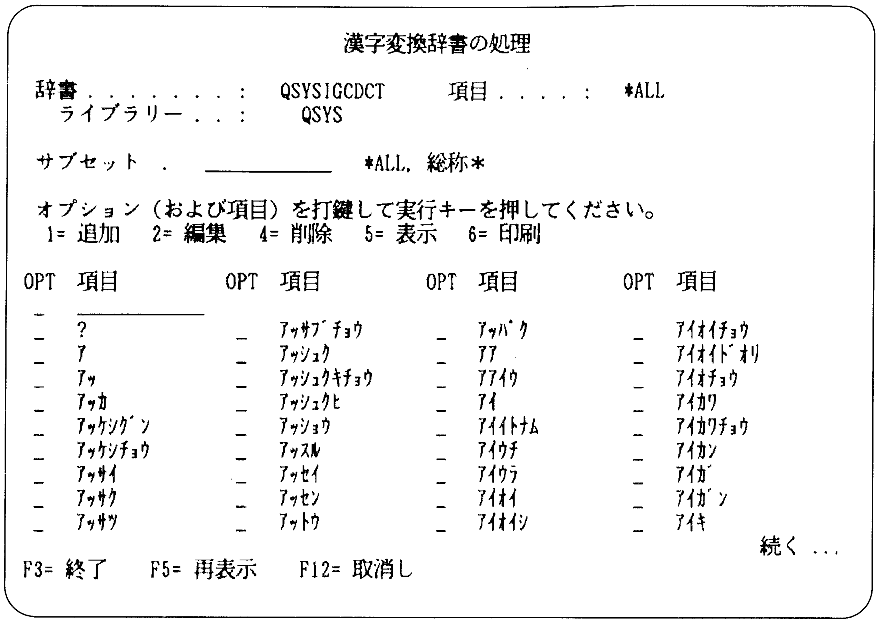
- Add entries to the dictionary (including adding the first entries to the dictionary after it is created). The dictionary can contain as many as 99,999 entries.
- Delete entries from the dictionary.
- Change entries in the dictionary, such as replacing the DBCS words related to an alphanumeric entry.
- Move the DBCS words related to an alphanumeric entry to rearrange the order in which they appear during DBCS conversion.

The only editing function that you can perform with QSYSIGCDCT, the system-supplied dictionary, is to move DBCS words related to an alphanumeric entry. Move words in order to rearrange the order in which they appear during DBCS conversion.

Displays Used for Editing a DBCS Conversion Dictionary: After you enter the EDTIGCDCT command, the system presents either the Work With DBCS Conversion Dictionary display or the Edit Related Words display, depending on the value entered for the ENTRY parameter on the command.

Work with DBCS Conversion Dictionary Display: Use the display in Figure B-3 on page B-20 to work with alphanumeric entries, such as choosing an entry to edit or deleting an entry. The system displays the Work with DBCS Conversion Dictionary display if you enter *ALL or a generic string for the ENTRY parameter of the EDTIGCDCT command.

See the discussion of the EDTIGCDCT command in the *CL Reference* manual for a complete description of the Work with DBCS Conversion Dictionary display.



```
                         漢字変換辞書の処理

辞書 . . . . . . . :   QSYSIGCDCT    項目 . . . . :   *ALL
  ライブラリー . . :    QSYS

サブセット  .   __________     *ALL, 総称*

オプション（および項目）を打鍵して実行キーを押してください。
 1= 追加   2= 編集   4= 削除   5= 表示   6= 印刷

OPT  項目          OPT  項目          OPT  項目          OPT  項目

 _   __________
 _   ?              _   ｱｯｻﾌﾞﾁｮｳ       _   ｱｯﾊﾞｸ          _   ｱｲｵｲﾁｮｳ
 _   ｱ              _   ｱｯｼｭｸ          _   ｱｱ             _   ｱｲｵｲﾄﾞｵﾘ
 _   ｱｯ             _   ｱｯｼｭｸｷﾁｮｳ      _   ｱｱｲｳ           _   ｱｲｵﾁｮｳ
 _   ｱｯｶ            _   ｱｯｼｭｸﾋ         _   ｱｲ             _   ｱｲｶﾜ
 _   ｱｯｹﾝｸﾞﾝ        _   ｱｯｼｮｳ          _   ｱｲｲﾄﾅﾑ         _   ｱｲｶﾜﾁｮｳ
 _   ｱｯｹｼﾁｮｳ        _   ｱｯｽﾙ           _   ｱｲｳﾁ           _   ｱｲｶﾝ
 _   ｱｯｻｲ           _   ｱｯｾｲ           _   ｱｲｳﾗ           _   ｱｲｶﾞ
 _   ｱｯｻｸ           _   ｱｯｾﾝ           _   ｱｲｵｲ           _   ｱｲｶﾞﾝ
 _   ｱｯｻﾂ           _   ｱｯﾄｳ           _   ｱｲｵｲｼ          _   ｱｲｷ
                                                                      続く ...
F3= 終了    F5= 再表示    F12= 取消し
```

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Figure B-3. Display for Work with DBCS Conversion Dictionary

Edit Related Words Display: Use this display to work with the DBCS words related to an alphanumeric entry. The system displays the Edit Related Words display if you enter a specific string for the ENTRY parameter. The system also displays the Edit Related Words display if you choose an entry to edit from the Work with DBCS Conversion Dictionary display. Figure B-4 on page B-21 is an example of the Edit Related Words display.

See the discussion of the EDTIGCDCT command in the *CL Reference* manual for a complete description of the Edit Related Words display.

Examples of Editing Operations: The following sections give examples of the editing operations that you can perform using the EDTIGCDCT displays:

- Beginning to edit a dictionary
- Adding the first entries in a dictionary
- Deleting an entry
- Moving a related word
- Ending editing the dictionary

Beginning to Edit a Dictionary: Enter the EDTIGCDCT command to start editing the dictionary for any type of editing operation. For example, to put the first entry in the dictionary, enter:

```
EDTIGCDCT IGCDCT(DBCSLIB/QUSRIGCDCT) +
  ENTRY(*ALL)
```

Or, to edit the entries beginning with the string ABC enter:

```
EDTIGCDCT IGCDCT(DBCSLIB/QUSRIGCDCT) +
  ENTRY('ABC*')
```

Adding the First Entries in a Dictionary: To add the first entries into a dictionary, do the following:

1. Specify ENTRY(*ALL) when entering the EDTIGCDCT command. For example, to edit the dictionary QUSRIGCDCT stored in the library DBCSLIB, enter:

   ```
   EDTIGCDCT IGCDCT(DBCSLIB/QUSRIGCDCT) +
     ENTRY(*ALL)
   ```

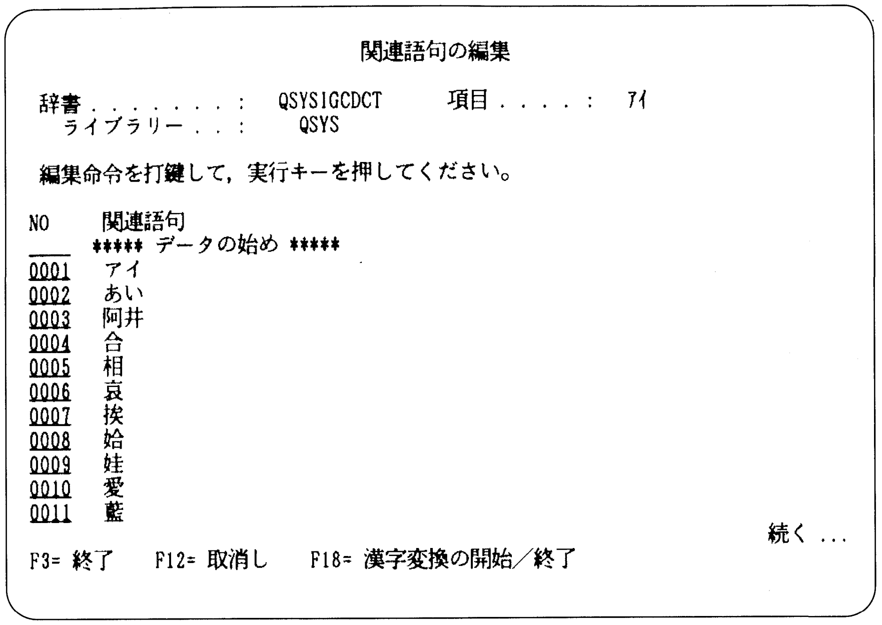
   The system displays the Work with DBCS Conversion Dictionary display.

2. Enter a `1` in the first option field in the list and enter an alphanumeric entry to be added to the dictionary in the entry field.

   The system then displays the Edit Related Words display showing only two lines of data: `BEGINNING OF DATA` and `END OF DATA`.

3. Enter an I in the *NBR* field beside the `BEGINNING OF DATA` line to insert a line.

4. Press the Enter key. The system displays a blank line.



```
                        関連語句の編集

 辞書 . . . . . . . :   QSYSIGCDCT      項目 . . . . :   ｱｲ
   ライブラリー . . :     QSYS

 編集命令を打鍵して，実行キーを押してください。

 NO     関連語句
 ____  ***** データの始め *****
 0001   アイ
 0002   あい
 0003   阿井
 0004   合
 0005   相
 0006   哀
 0007   挨
 0008   姶
 0009   娃
 0010   愛
 0011   藍
                                                           続く ...
 F3= 終了    F12= 取消し    F18= 漢字変換の開始／終了
```

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Figure B-4. Display for Edit Related Words

5. On the blank line, enter a DBCS word to be related to the new alphanumeric entry.

   If you enter data on the inserted line and leave the cursor on that line, another new line appears below when you press the Enter key. You can enter another DBCS word on this line, or delete it by leaving it blank, and pressing the Enter key.

6. When you finish adding this first entry, press F12 to get the Exit Dictionary Entry display. Enter the Y option to save the entry and then return to the Work With DBCS Conversion Dictionary display. Enter option 1 again and enter another alphanumeric entry in the entry field to continue adding entries to the dictionary, or press F3 to end editing the dictionary.

Moving a Related Word: Moving the words related to an alphanumeric entry changes the order in which the words appear during DBCS conversion. To move a word, do the following:

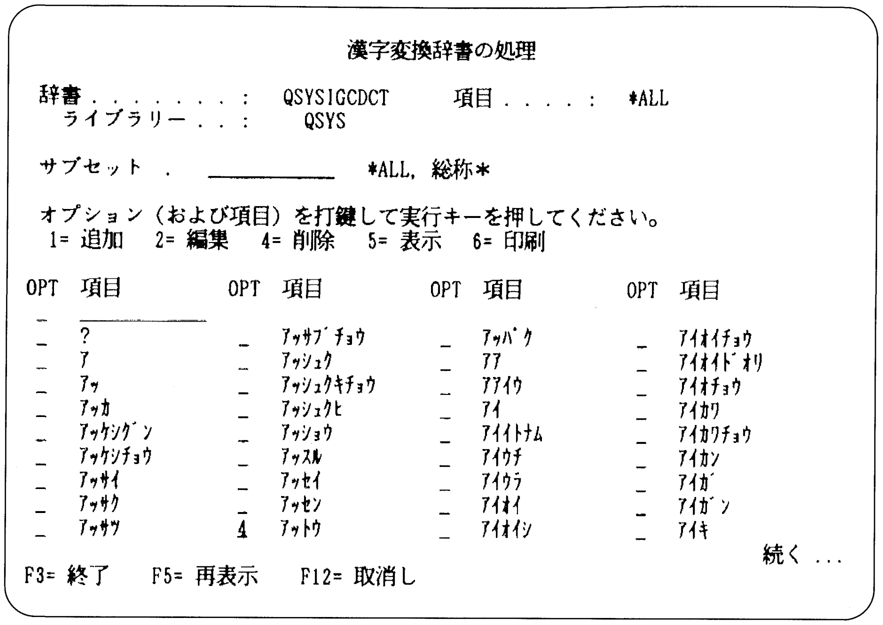
1. Display the Edit Related Words display for the entry in which you want to move DBCS words, either by entering a specific entry with the EDTIGCDCT command, or by choosing an entry to edit from the Work with DBCS Conversion Dictionary display.
2. When the display appears, enter an `M` in the *NBR* field beside the DBCS word to be moved.
3. Enter an `A` in the *NBR* field of the line after which the word will be moved.
4. Press the Enter key. The system moves the word on the line marked `M` to a position immediately following the line marked with an `A`.

Deleting an Entry: Enter a `4` in the input field beside the entry to be deleted as shown in Figure B-5 on page B-22.

Ending the Editing Process: To end the editing operation, press F3. The Exit Dictionary Entry display is displayed, and you can choose to save the entry or not. The system then returns you to your basic working display, such as the Command Entry display.

Suggestions for Editing the Dictionary: When editing the DBCS conversion dictionary, consider the following:

- You can use DBCS conversion with the Edit Related Words display to enter related words into a user-created dictionary. See "DBCS Conversion (for Japanese Use Only)" on page B-23 for information on this procedure.



```
                           漢字変換辞書の処理

 辞書 . . . . . . . :   QSYSIGCDCT       項目 . . . . :   *ALL
   ライブラリー . . :     QSYS

 サブセット  .    __________    *ALL, 総称*

 オプション（および項目）を打鍵して実行キーを押してください。
  1= 追加   2= 編集   4= 削除   5= 表示   6= 印刷

OPT  項目          OPT  項目          OPT  項目          OPT  項目
 _   __________
 _   ?              _   ｱｯｻﾌﾞﾁｮｳ       _   ｱｯﾊﾟｸ         _   ｱｲｵｲﾁｮｳ
 _   ｱ              _   ｱｯｼｭｸ          _   ｱｱ            _   ｱｲｵｲﾄﾞｵﾘ
 _   ｱｯ             _   ｱｯｼｭｸｷﾁｮｳ      _   ｱｱｲｳ          _   ｱｲｵﾁｮｳ
 _   ｱｯｶ            _   ｱｯｼｭｸﾋ         _   ｱｲ            _   ｱｲｶﾜ
 _   ｱｯｹｼｸﾞﾝ        _   ｱｯｼｮｳ          _   ｱｲｲﾄﾅﾑ        _   ｱｲｶﾜﾁｮｳ
 _   ｱｯｹｼﾁｮｳ        _   ｱｯｽﾙ           _   ｱｲｳﾁ          _   ｱｲｶﾝ
 _   ｱｯｻｲ           _   ｱｯｾｲ           _   ｱｲｳﾗ          _   ｱｲｶﾞ
 _   ｱｯｻｸ           _   ｱｯｾﾝ           _   ｱｲｵｲ          _   ｱｲｶﾞﾝ
 _   ｱｯｻﾂ           4   ｱｯﾄｳ           _   ｱｲｵｲｼ         _   ｱｲｷ
                                                                   続く ...
F3= 終了    F5= 再表示    F12= 取消し
```

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Figure B-5. Display for Deleting a Conversion Dictionary Entry

- Place the most commonly used DBCS words at the beginning of the list of related words on the Edit Related Words display. This simplifies DBCS conversion because the system displays the related words in the same order in which those words are listed in the dictionary.

Displaying and Printing the DBCS Conversion Dictionary

Use the Display DBCS Conversion Dictionary (DSPIGCDCT) command to display and print the DBCS conversion dictionary. You can display or print the entire dictionary or just a certain part of it, depending on the value you specify for the ENTRY parameter.

For example, to print the entry ABC from the dictionary QUSRIGCDCT and its related words, enter:

```
DSPIGCDCT IGCDCT(DBCSLIB/QUSRIGCDCT)  +
  ENTRY(ABC) OUTPUT(*PRINT)
```

To display all of the entries from the system-supplied dictionary QSYSIGCDCT and their related words, enter:

```
DSPIGCDCT IGCDCT(QSYS/QSYSIGCDCT)
```

Figure B-6 on page B-23 provides an example of the display produced by the DSPIGCDCT command. It shows alphanumeric entries and their related words.

See the discussion of the DSPIGCDCT command in the *CL Reference* manual for a complete description of the command and the display it produces.

Deleting a DBCS Conversion Dictionary

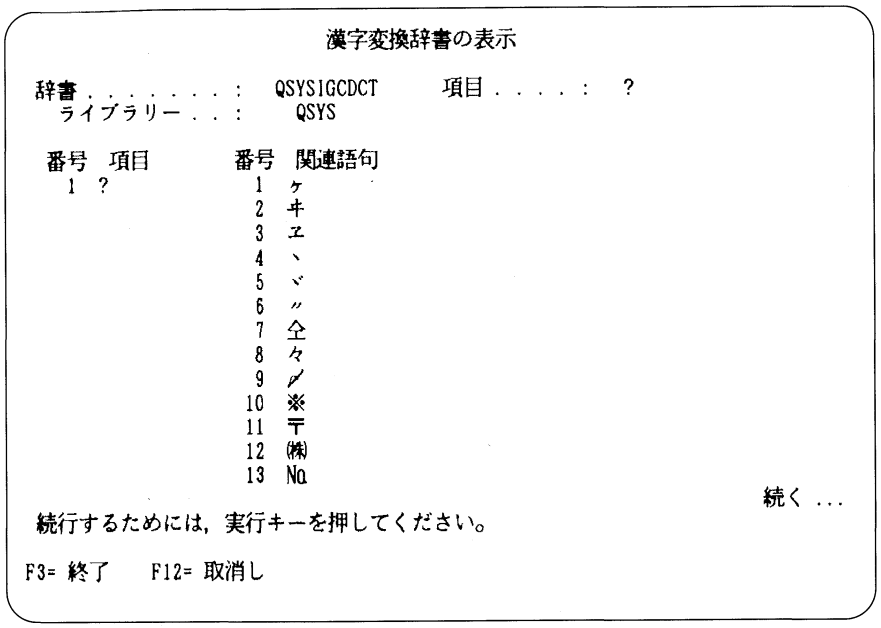
Use the Delete DBCS Conversion Dictionary (DLTIGCDCT) command to delete a DBCS conversion dictionary from the system.

In order to delete the dictionary, you must have object existence authority to the dictionary and object operational authorities to the library in which the dictionary is stored.

When you delete a dictionary, make sure that you specify the correct library name. It is possible that many users have their own dictionaries, each named QUSRIGCDCT, stored in their libraries. If you do not specify any library name, the system deletes the first DBCS conversion dictionary in your library list.

For example, to delete the DBCS conversion dictionary QUSRIGCDCT in the library DBCSLIB, enter:

```
DLTIGCDCT IGCDCT(DBCSLIB/QUSRIGCDCT)
```



```
                          漢字変換辞書の表示

 辞書 . . . . . . . . :   QSYSIGCDCT      項目 . . . . :   ?
   ライブラリー . . :       QSYS

  番号  項目          番号  関連語句
    1  ?                 1  ヶ
                         2  ヰ
                         3  ヱ
                         4  ヽ
                         5  ヾ
                         6  〃
                         7  仝
                         8  々
                         9  〆
                        10  ※
                        11  〒
                        12  ㈱
                        13  №
                                                                続く ...
 続行するためには，実行キーを押してください。

F3= 終了    F12= 取消し
```

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Figure B-6. Display Produced by the DSPIGCDCT Command

DBCS Conversion (for Japanese Use Only)

When you use DBCS display stations to enter double-byte data, you may use the various data entry methods supported on the display station, or you may choose to use the AS/400 DBCS conversion support. DBCS conversion lets you enter an alphanumeric entry or DBCS code and convert the entry or code to its related DBCS word. DBCS conversion is intended for Japanese character sets and its use is limited for application to other double-byte character sets.

Specifically, DBCS conversion lets you convert the following:

- A string of alphanumeric characters to a DBCS word
- English alphanumeric characters to double-byte alphanumeric characters
- Alphanumeric Katakana to double-byte Hiragana and Katakana letters
- A *DBCS code* to its corresponding double-byte character
- A *DBCS number* to its corresponding double-byte character

Where You Can Use DBCS Conversion

You can use DBCS conversion in the following instances:

- When entering data into input fields of certain SEU displays. For information about which fields you can use with DBCS conversion, refer to the *SEU User's Guide and Reference*.
- When prompting for double-byte data using QCMDEXEC. For instructions on this procedure, see the *CL Reference* manual.
- When entering data into input fields of DBCS display files in user-written applications. Specify DBCS conversion with the DDS keyword IGCCNV. See the *DDS Reference* manual for information on this keyword.
- When editing the related words on the Edit Related Words display, which is displayed when editing the DBCS conversion dictionary (EDTIGCDCT command). See “Editing a DBCS Conversion Dictionary” on page B-19 for information on the Edit Related Words display.

How DBCS Conversion Works

DBCS conversion is an interactive function between you and the system in which you enter an alphanumeric entry. The system displays related DBCS words, and you choose which word to use.

The system determines which words are related to an alphanumeric entry by checking DBCS conversion dictionaries. The system checks two DBCS conversion dictionaries when performing DBCS conversion. It checks the first user-created dictionary named QUSRIGCDCT found when searching a user's library list. Then, it checks the system-supplied dictionary, QSYSIGCDCT, stored in the library QSYS. (QSYSIGCDCT contains only Japanese double-byte characters.) You can create other user dictionaries, and you can give them names other than QUSRIGCDCT, but the system only refers to the first user-created dictionary named QUSRIGCDCT found in your library list when performing DBCS conversion.

After checking the dictionaries, the system displays words related to the alphanumeric entry. You then position the cursor under the word of your choice, and press the Enter key. The system enters that word where the cursor was positioned when you began DBCS conversion.

Using DBCS Conversion

You can change the user-defined dictionary used during DBCS conversion. Before you change the user-defined dictionary, end your application program or end the command that the system is performing. Then change the dictionary that is used by changing the library list (using the CHGLIBL command).

You can create your own DBCS conversion dictionary for DBCS conversion. The system-supplied dictionary is a collection of entries with a Japanese pronunciation expressed in alphanumeric characters and Japanese DBCS words related to the entry. See "Creating a DBCS Conversion Dictionary" on page B-18 for instructions on this procedure.

If no user-created dictionary is found, the system refers only to QSYSIGCDCT. See "DBCS Conversion Dictionaries" on page B-17 for more information on creating and using DBCS conversion dictionaries.

Performing DBCS Conversion

The following procedure describes how to convert one alphanumeric entry to its related DBCS word using DBCS conversion. You must start DBCS conversion separately for each field in which you want to enter double-byte data.

Note: DBCS conversion is intended for Japanese data entry. Its use with other languages is limited.

While performing DBCS conversion, you can display information about the function by pressing the Help key. Help is available until you end DBCS conversion.

1. Position the cursor in the field in which you want to enter double-byte characters. Insert shift-control characters into the field if they have not yet been inserted. To find out how to insert shift characters, see "Inserting Shift-Control Characters" on page B-8.
2. Position the cursor under the shift-in character, in a blank area between the shift-control characters, or under a double-byte character.
3. Press the function key used to start DBCS conversion.

   In SEU, as well as from the Edit Related Words display (displayed when using the EDTIGCDCT command), press F18. The system displays the following prompt line:

```
_  ____________  _
A       B        C
```

4. Enter the following values:
   a. In the field marked A, enter one of the following:

I	Inserts the converted word before the character under which you positioned the cursor in step 2.
R	Replaces the character under which you positioned the cursor in step 2 with the converted word.

   b. In the field marked B, enter one of the following:

1) A string of alphanumeric characters to be converted. The string can have as many as 12 characters.

2) The 4-character DBCS code of a double-byte character.

3) The 2- to 5-digit DBCS number of a double-byte character.

c. In the field marked C enter one of the following conversion codes:

No entry	Converts the entry in field B from alphanumeric to double-byte by referring to the DBCS conversion dictionaries.
G	Converts the 2- to 5-digit DBCS number in field B to the character it represents.
H	Converts the entry in field B to double-byte Hiragana, uppercase alphabetic, numeric, or special characters.
K	Converts the entry in field B to double-byte Hiragana, lowercase alphabetic, numeric, or special characters.
X	Converts the 4-character DBCS code to the character it represents.

5. Press the Enter key. The system displays the following prompt line:

```
_  ____________  _  ______________________________ +
A       B        C                D
```

6. In the field marked D, the system displays words related to the entry in field B.

   If you see a plus (+) sign following the last displayed word, the system has additional words to display. Press the Roll Up key to see these entries. Then, to return to a word displayed earlier, press the Roll Down key.

   If a word is shown in a reverse image, the word contains an embedded blank.

7. Choose the DBCS word from field D that best suits your needs by positioning the cursor under that DBCS word.

8. Press the Enter key. The system enters the word where the cursor was positioned in step 2, either by inserting the word or by replacing another word, depending on what you entered in field A.

9. Do one of the following:

   a. Continue using DBCS conversion. Repeat 4 on page B-24 through 8 until you finish entering data into the field.

   b. End DBCS conversion by pressing the *same* function key used to start conversion. The system automatically ends conversion when you reach the end of the field.

      In SEU, as well as from the Edit Related Words display (displayed when using the EDTIGCDCT command), press F18.

      Note: Until DBCS conversion is ended, you cannot perform any other system function. For example, the F3 key cannot be used to exit an SEU display.

Examples

Converting One Alphanumeric Entry to a Double-Byte Entry: The following example shows how to convert one entry and enter it into a field.

1. Position the cursor in the field in which you want to enter double-byte data (see Figure B-7 on page B-26).

2. Insert shift-control characters into the field. See "Inserting Shift-Control Characters" on page B-8 for instructions on inserting shift-control characters.

3. Press the function key used to start DBCS conversion. For the display just shown, the function key is F18. The system displays a prompt line as shown in Figure B-8 on page B-27.

   Because the cursor was placed under a shift-in character when conversion was started, conversion automatically is set to I (inserting the converted word).

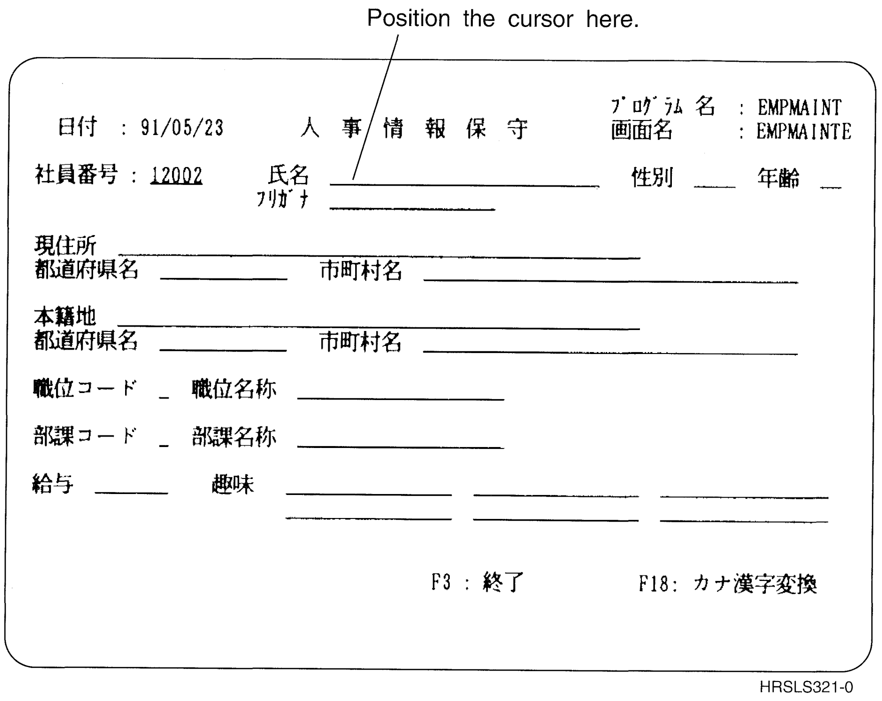
4. Enter an alphanumeric entry to be converted in the second field.

   Leave the third field blank. See the example screen in Figure B-9 on page B-27.

5. Press the Enter key. The system displays related DBCS words.

6. Position the cursor under the DBCS word that you want to enter, if that word is not the first DBCS word shown. In the example screen shown in Figure B-10 on page B-28, the first word is the one to be entered.

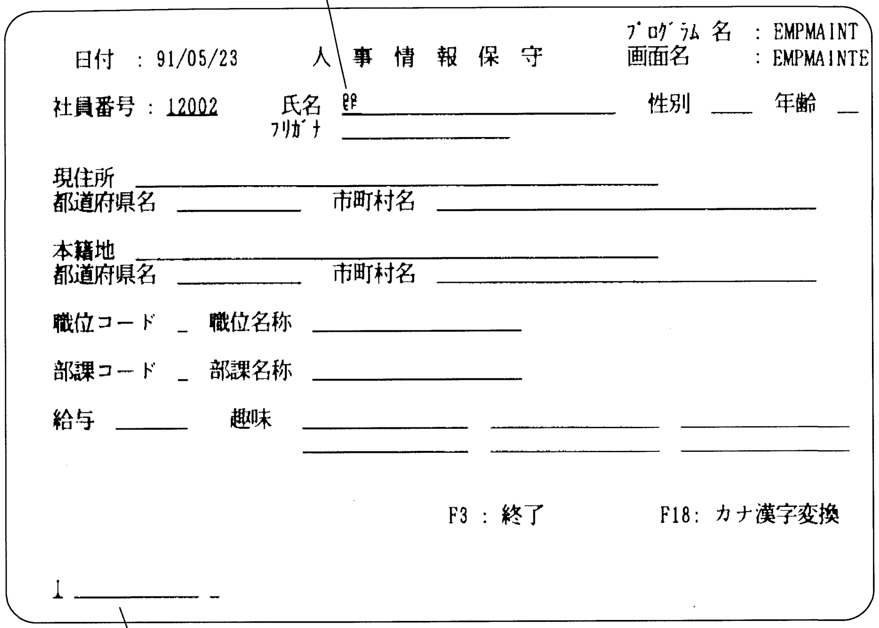
7. Press the Enter key. The DBCS word is entered into the field as shown in Figure B-11 on page B-28.



```
                                                     ﾌﾟﾛｸﾞﾗﾑ 名  : EMPMAINT
  日付  : 91/05/23      人 事 情 報 保 守            画面名      : EMPMAINTE

社員番号 : 12002      氏名 _______________________   性別 ___   年齢 __
                     ﾌﾘｶﾞﾅ ______________

現住所 ______________________________________________
都道府県名 __________    市町村名 ______________________________

本籍地 ______________________________________________
都道府県名 __________    市町村名 ______________________________

職位コード _  職位名称 _________________

部課コード _  部課名称 _________________

給与 ______    趣味  ______________  ______________  ______________
                     ______________  ______________  ______________

                               F3 : 終了          F18: カナ漢字変換
```

Figure B-7. Example Screen 1

Notice that shift control characters have been inserted into the field.



```
                                                  ﾌﾟﾛｸﾞﾗﾑ 名  : EMPMAINT
 日付  : 91/05/23       人 事 情 報 保 守         画面名      : EMPMAINTE

社員番号 : 12002       氏名 ________________    性別 ___   年齢 _
                      ﾌﾘｶﾞﾅ __________

現住所 ______________________________
都道府県名 ________     市町村名 ______________________

本籍地 ______________________________
都道府県名 ________     市町村名 ______________________

職位コード _  職位名称 ____________

部課コード _  部課名称 ____________

給与 _____     趣味  __________  __________  __________
                     __________  __________  __________

                                 F3 : 終了        F18: カナ漢字変換

1 ________ _
```

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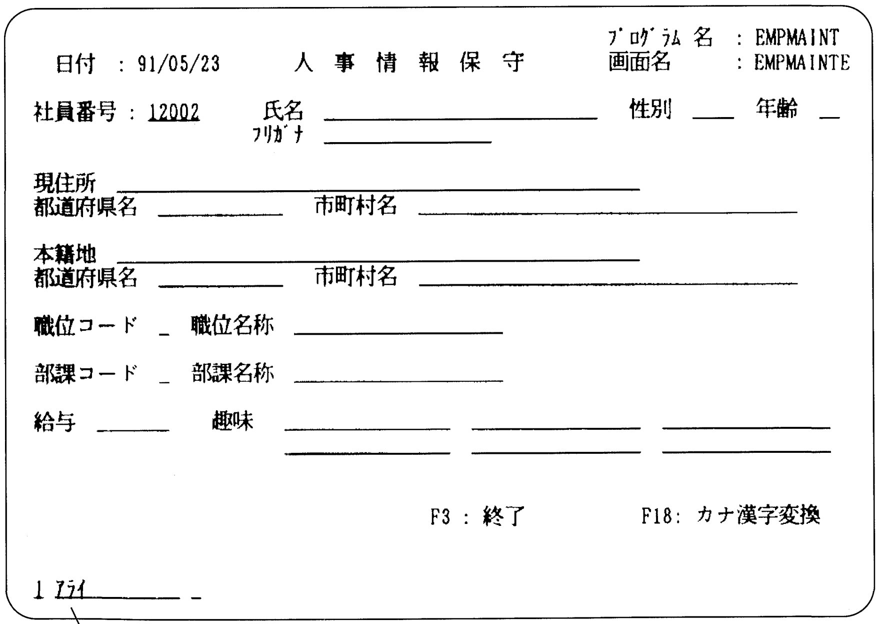
The prompt line.

Figure B-8. Example Screen 2



```
                                                  ﾌﾟﾛｸﾞﾗﾑ 名  : EMPMAINT
 日付  : 91/05/23       人 事 情 報 保 守         画面名      : EMPMAINTE

社員番号 : 12002       氏名 ________________    性別 ___   年齢 _
                      ﾌﾘｶﾞﾅ __________

現住所 ______________________________
都道府県名 ________     市町村名 ______________________

本籍地 ______________________________
都道府県名 ________     市町村名 ______________________

職位コード _  職位名称 ____________

部課コード _  部課名称 ____________

給与 _____     趣味  __________  __________  __________
                     __________  __________  __________

                                 F3 : 終了        F18: カナ漢字変換

1 ｱﾗｲ______ _
```

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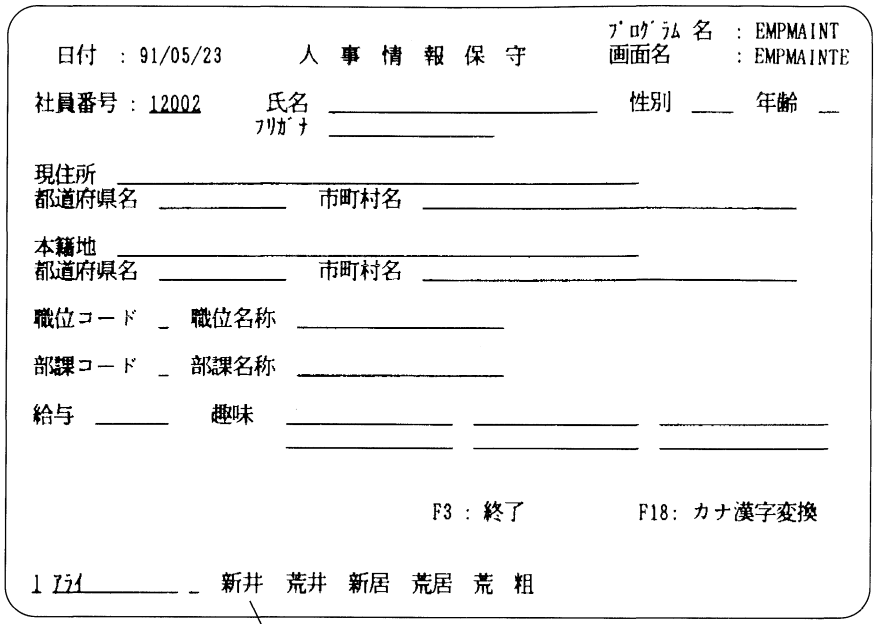
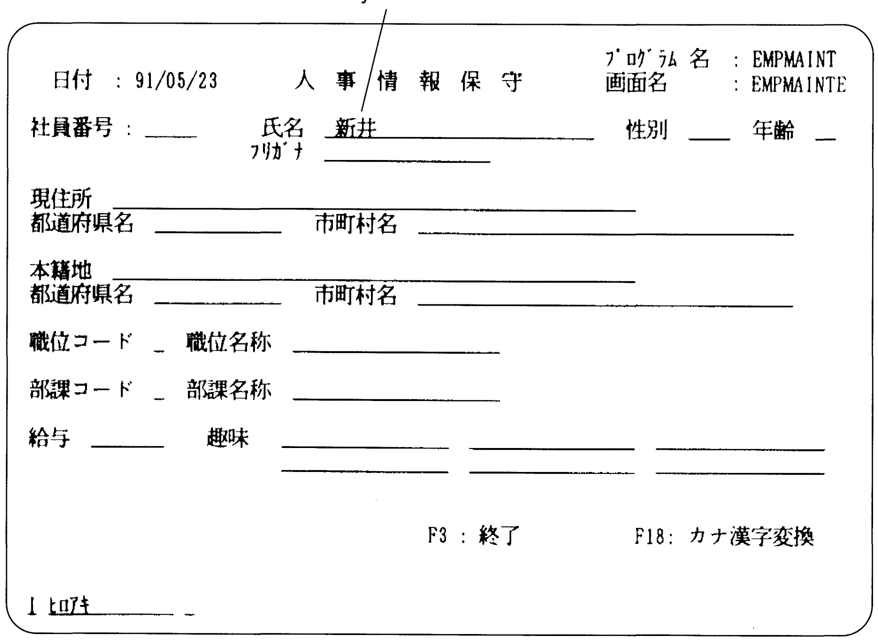
Enter an alphameric entry here.

Figure B-9. Example Screen 3



```
                                                        ﾌﾟﾛｸﾞﾗﾑ 名  : EMPMAINT
   日付  : 91/05/23        人 事 情 報 保 守          画面名      : EMPMAINTE

 社員番号 : 12002       氏名 ___________________     性別 ___   年齢 _
                      ﾌﾘｶﾞﾅ ____________

 現住所 _____________________________________
 都道府県名 _________      市町村名 ___________________________

 本籍地 _____________________________________
 都道府県名 _________      市町村名 ___________________________

 職位コード _  職位名称 _______________

 部課コード _  部課名称 _______________

 給与 _____      趣味  ____________  ____________  ____________
                       ____________  ____________  ____________

                                   F3 : 終了         F18: カナ漢字変換

 1 ｱﾗｲ________ _  新井  荒井  新居  荒居  荒  粗
```

Figure B-10. Example Screen 4



```
                                                        ﾌﾟﾛｸﾞﾗﾑ 名  : EMPMAINT
   日付  : 91/05/23        人 事 情 報 保 守          画面名      : EMPMAINTE

 社員番号 : ____        氏名 新井________________     性別 ___   年齢 _
                      ﾌﾘｶﾞﾅ ____________

 現住所 _____________________________________
 都道府県名 _________      市町村名 ___________________________

 本籍地 _____________________________________
 都道府県名 _________      市町村名 ___________________________

 職位コード _  職位名称 _______________

 部課コード _  部課名称 _______________

 給与 _____      趣味  ____________  ____________  ____________
                       ____________  ____________  ____________

                                   F3 : 終了         F18: カナ漢字変換

 1 ﾋﾛｱｷ_______ _
```

Figure B-11. Example Screen 5

Converting Many Alphanumeric Entries at One Time: You do not have to continually start DBCS conversion for each alphanumeric entry. Instead, you can do the following:

1. Enter as many alphanumeric entries as will fit into field B. Separate each entry by a blank. Field B contains space for 12 alphanumeric characters:

```
These are the entries to be converted.
   |    |    |
 I XXX_YYY_ZZZ_ _

 A       B       C                     D
```

The system converts the entries one at a time, in the order entered. When the system converts an entry, the system displays the DBCS words related to that entry in field D.

2. Position the cursor under the DBCS word that you want to use.
3. Press the Enter key. Then, the system adjusts field B; the next entry is moved to the position farthest left of the field. The DBCS words related to that entry are displayed in field D.

   At this time, you can enter additional alphanumeric entries to be converted at the end of field B.

Converting Alphanumeric Blanks to DBCS Blanks: You can convert alphanumeric blanks (one position wide) to DBCS blanks (two positions wide, the same width as double-byte characters) using DBCS conversion.

To convert blanks, do the following:

1. Enter one or more blanks in field B.

```
_ ___________ _

A       B       C                   D
```

2. Press the Enter key. The system displays in field D the same number of DBCS blanks as the alphanumeric blanks that you entered in field B. The DBCS blanks are displayed in reverse image.
3. Press the Enter key again. The system enters the DBCS blanks into the field where you started DBCS conversion.

Changing Alphanumeric Entries or Conversion Code: If none of the related words shown during conversion are suitable candidates for the alphanumeric entry, and you would like to try a conversion again (by using a different type of conversion or a different alphanumeric entry), do the following:

1. Move the cursor to field B. For example:

```
Move the cursor here.
  |
  XXXXXX
_ ___________ _ _________________________

A       B       C              D
```

2. Do one of the following:
   a. Position the cursor under the first position of the field in which you want to enter alphanumeric entries.
   b. Enter a different alphanumeric entry.
   c. Change the conversion code in field C, such as from H to K.
3. Press the Enter key.
4. Continue DBCS conversion.

Using DBCS Conversion to Enter Words in the DBCS Conversion Dictionary: You can use DBCS conversion when entering DBCS words on the Edit Related Words display.

To start DBCS conversion, do the following:

1. Position the cursor at the position where the DBCS word is to be entered.
2. Press F18. The system displays the conversion prompt line at the bottom of the display.

Perform DBCS conversion according to the instructions described in "Performing DBCS Conversion" on page B-24.

Note: You must start and end DBCS conversion separately for each line of data.

Considerations for Using DBCS Conversion: Consider the following when performing DBCS conversion:

- You can only perform DBCS conversion at a DBCS display station, using the 5556 keyboard.
- You may use DBCS conversion to insert or replace characters only if the line in which double-byte characters are to be inserted has sufficient space.
  – The space available for inserting characters is equal to the number of characters

from the last character on the line that is not blank to the right edge of the display.

- The space available for replacing characters is equal to the number of characters from the cursor position (including the character marked by the cursor) to the end of the DBCS portion of the field.

The following happens when you do not have enough space:

- If you try to insert or replace a string of characters where there is no space available, the system sends a message.
- If you ignore the message and press the Enter key again, the system truncates the characters in excess of the limit from the right side of the string to be inserted or replaced.

Bibliography

The following AS/400 manuals contain information you may need. The manuals are listed with their full title and base order number. When these manuals are referred to in this guide, the short title listed is used.

- *Application Development Tools: Character Generator Utility User's Guide*, SC09-1170, provides the application programmer or system programmer with information about using the Application Development Tools character generator utility (CGU) to create and maintain a double-byte character set (DBCS) on the system.

  Short title: *CGU User's Guide.*

- *Application Development Tools: Screen Design Aid User's Guide and Reference*, SC09-1340, provides the application programmer, system programmer, or data processing manager with information about using the Application Development Tools screen design aid (SDA) to design, create, and maintain displays, menus, and online help information.

  Short title: *SDA User's Guide and Reference.*

- *Application Development Tools: Source Entry Utility User's Guide and Reference*, SC09-1338, provides the application programmer or system programmer with information about using the Application Development Tools source entry utility (SEU) to create and edit source members.

  Short title: *SEU User's Guide and Reference.*

- *Basic Backup and Recovery Guide*, SC41-0036, provides the system programmer with information to plan a backup and recovery strategy. Also included are procedures to implement your backup and recover strategy, how to add disk units to an existing auxiliary storage pool (ASP), and how to recover from disk unit failures.

  Short title: *Basic Backup and Recovery Guide.*

- *Advanced Backup and Recovery Guide*, SC41-8079, provides the system programmer with information about starting checksum or mirrored protection and recovering from disk unit failure when these functions are in effect.

  Short title: *Advanced Backup and Recovery Guide.*

- *Communications: Intersystem Communications Function Programmer's Guide*, SC41-9590, provides the application programmer with the information needed to write application programs that use AS/400 communications and ICF files. It also contains information on data description specifications (DDS) keywords, system-supplied formats, return codes, file transfer support, and programming examples.

  Short title: *ICF Programmer's Guide.*

- *Communications: Operating System/400* Communications Configuration Reference*, SC41-0001, provides information for the application programmer or system programmer about configuration commands and defining lines, controllers, and devices.

  Short title: *Communications Configuration Reference.*

- *Data Description Specifications Reference*, SC41-9620, provides the application programmer with detailed descriptions of the entries and keywords needed to describe database files (both logical and physical) and certain device files (for displays, printers, and ICF) external to the user's programs.

  Short title: *DDS Reference.*

- *Database Guide*, SC41-9659, provides the application programmer or system programmer with a detailed discussion of the AS/400 database organization, including information on how to create, describe, and manipulate database files on the system.

  Short title: *Database Guide.*

- *Device Configuration Guide*, SC41-8106, provides the system operator or system administrator with information on how to do an initial local hardware configuration and how to change that configuration. It also contains conceptual information for device configuration, and planning information for device configuration on the 9406, 9404, and 9402 System Units.

  Short title: *Device Configuration Guide.*

- *Distributed Data Management Guide*, SC41-9600, provides the application programmer or system programmer with information about remote file processing. It describes how to define a remote file to OS/400 distributed data management (DDM), how to create a DDM file, which file utilities are supported through DDM, and the requirements of OS/400 DDM as related to other systems.

  Short title: *DDM Guide.*

- *Guide to Programming Application and Help Displays*, SC41-0011, provides information about creating and maintaining screens for applications, creating online help information, and working with display files on the AS/400 system.

  Short title: *Guide to Programming Displays.*

- *Guide to Programming for Printing*, SC41-8194, provides information on how to understand and control printing: printing elements and concepts, printer file

support, print spooling support, printer connectivity, advanced function printing, and printing with personal computers.

Short title: *Guide to Programming for Printing.*

- *Guide to Programming for Tape and Diskette*, SC41-0012, provides information about creating and maintaining tape device files and diskette device files.

  Short title: *Guide to Programming for Tape and Diskette.*

- *Languages: System/36-Compatible COBOL User's Guide and Reference*, SC09-1160, provides information about using COBOL in the System/36 environment on the AS/400 system. It provides information on how to program in COBOL in the AS/400 System/36 environment and how to use existing System/36 COBOL programs.

  Short title: *System/36-Compatible COBOL User's Guide and Reference.*

- *Languages: System/36-Compatible RPG II User's Guide and Reference*, SC09-1162, provides programming information for the RPG II language on the AS/400 system for those who have a basic understanding of data processing concepts and of the RPG II language. It explains how to design, code, enter, compile, test, and run RPG II programs.

  Short title: *System/36-Compatible RPG II User's Guide and Reference.*

- *Office Services Concepts and Programmer's Guide*, SC41-9758, provides the application programmer with information about writing applications that use OfficeVision/400* functions. The manual includes an overview of calendar services, directory services, document distribution services, document library services, security services, text search services, word processing services, and gives information on finding new ways to integrate applications with OfficeVision/400.

  Short title: *Office Services Concepts and Programmer's Guide.*

- *Programming: Concepts and Programmer's Guide for the System/36 Environment*, SC41-9663, provides information identifying the functional and operational differences between the applications process on the System/36 and in the System/36 environment on the AS/400 system.

  Short title: *Concepts and Programmer's Guide for the System/36 Environment.*

- *Programming: Control Language Programmer's Guide*, SC41-8077, provides a wide-ranging discussion of programming topics, including a general discussion of objects and libraries, control language (CL) programming, controlling flow and communicating between programs, working with objects in CL programs, and creating CL programs. Other topics include predefined and immediate messages and message handling, defining and creating user-defined commands and menus, and application testing, including debug mode, breakpoints, traces, and display functions.

  Short title: *CL Programmer's Guide.*

- *Programming: Control Language Reference*, SC41-0030, provides a description of the control language (CL) and its commands. Each command is defined including its syntax diagram, parameters, default values, and keywords.

  Short title: *CL Reference.*

- *Programming: Work Management Guide*, SC41-8078, provides information about how to create and change a work management environment.

  Short title: *Work Management Guide.*

- *Security Reference*, SC41-8083, provides the system programmer with information about planning, designing, and auditing security. Includes information about security system values, user profiles, and resource security.

  Short title: *Security Reference.*

- *Basic Security Guide*, SC41-0047, provides basic information about planning and setting up security on the AS/400 system.

  Short title: *Basic Security Guide.*

- *System Concepts*, GC41-9802, provides the programmer and system user with information about the concepts related to the overall design and use of the AS/400 system and its operating system. This manual includes general information about topics such as user interface, object management, work management, system management, data management, database, communications, environments, OfficeVision/400, PC Support/400, and architecture.

  Short title: *System Concepts.*

- *System Operations: Font Management Aid User's Guide,* SC18-2216, provides information about how to maintain or use double-byte character set (DBCS) user-defined characters. It also shows how to maintain and distribute user-defined characters and associated data entry dictionaries between the AS/400 system and its DBCS display stations.

- *System Operator's Guide*, SC41-8082, provides information about how to use the system unit control panel and console, send and receive messages, respond to error messages, start and stop the system, use control devices, work with program temporary fixes (PTFs), and process and manage jobs on the system.

Short title: *Operator's Guide*.

- *Systems Application Architecture* OfficeVision/400*: Using OfficeVision/400 Word Processing*, SC41-9618, provides the office user with information on how to use the word processing functions of SAA OfficeVision/400, and it can be used with the OfficeVision/400 online information.

  Short title: *Using OfficeVision/400* Word Processing*.

- *Utilities: Interactive Data Definition Utility User's Guide*, SC41-9657, provides the administrative secretary, business professional, or programmer with detailed information on how to use OS/400 interactive data definition utility (IDDU) to describe data dictionaries, files, and records to the system.

  Short title: *IDDU User's Guide*.

- *Utilities: Kanji Print Function User's Guide and Reference*, SH18-2179, provides information about using the Kanji printer function (KPF) to create and maintain symbols and tailored forms.

- *Utilities: Sort User's Guide and Reference*, SC09-1363, provides the application programmer with information about using the sort function for identifying input and output files, specifying sort options, using effective sort run time, and identifying double-byte character set (DBCS) sort information.

  Short title: *Sort User's Guide and Reference*.

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